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For related information see also *Astronautics*.

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VOLUME 22 NUMBER 6/MARCH 23, 1984

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 767

02 AERODYNAMICS 779

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

03 AIR TRANSPORTATION AND SAFETY 784

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 785

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 786

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 788

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 789

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 791

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 792

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) 792

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 793

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 793

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 793

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 794

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATION, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 795

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION N.A.

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 796

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

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Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) **796**
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS **797**
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **800**
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics.*

26 METALLIC MATERIALS **803**
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **808**
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **812**
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics.*

31 ENGINEERING (GENERAL) **813**
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **822**
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING **829**
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER **831**
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY **846**
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS **848**
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **851**
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **854**
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **856**
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES **863**
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION **872**
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION **875**
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS **875**
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY **879**
Includes weather forecasting and modification.

48 OCEANOGRAPHY **883**
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) **885**
Includes genetics.

52 AEROSPACE MEDICINE **886**
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES **891**
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT **893**
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY **N.A.**
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) **895**

60 COMPUTER OPERATIONS AND HARDWARE **895**
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE **897**
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS **899**
Includes computer networks.

63 CYBERNETICS **899**
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS **900**
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY **904**
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS **905**
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS **906**
Includes topology and number theory.

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Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering.*

70 PHYSICS (GENERAL) **906**
For geophysics see *46 Geophysics.* For astrophysics see *90 Astrophysics.* For solar physics see *92 Solar Physics.*

71 ACOUSTICS **907**
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS **910**
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS **916**
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS **917**
Includes light phenomena.

75 PLASMA PHYSICS **919**
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS **922**
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS **926**
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) **927**
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT **932**
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82 DOCUMENTATION AND INFORMATION SCIENCE **934**
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Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE **N.A.**
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION **N.A.**
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) **N.A.**

89 ASTRONOMY **936**
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS **939**
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION **939**
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS **940**
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION **941**
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

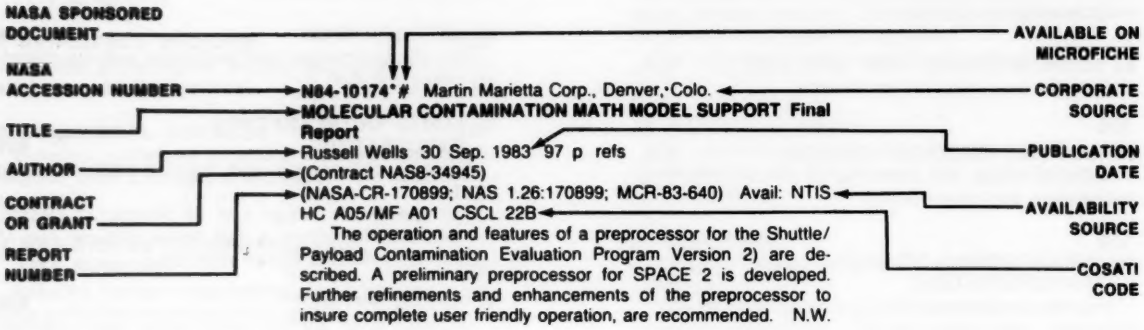
GENERAL

99 GENERAL **N.A.**

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX **I-1**
PERSONAL AUTHOR INDEX **I-57**
CORPORATE SOURCE INDEX **I-65**
CONTRACT NUMBER INDEX **I-79**
REPORT/ACCESSION NUMBER INDEX **I-83**

TYPICAL CITATION AND ABSTRACT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N84-10174*# Martin Marietta Corp., Denver, Colo.
MOLECULAR CONTAMINATION MATH MODEL SUPPORT Final Report
Russell Wells 30 Sep. 1983 97 p refs
(Contract NAS8-34945)
(NASA-CR-170899; NAS 1.26:170899; MCR-83-640) Avail: NTIS
HC A05/MF A01 CSCL 22B
The operation and features of a preprocessor for the Shuttle/ Payload Contamination Evaluation Program Version 2) are described. A preliminary preprocessor for SPACE 2 is developed. Further refinements and enhancements of the preprocessor to insure complete user friendly operation, are recommended. N.W.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N84-15025# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AEROACOUSTICS: TEN YEARS OF RESEARCH
1983 313 p refs Proc. of Lecture Series, Rhode Saint Genese, Belgium, 18-22 Apr. 1983
(VKI-LS-1983-05) Avail: NTIS HC A14/MF A01

Noise certification of propeller aircraft and helicopters; helicopter rotor noise generation; experimental methods in compressor noise studies; noise source location/assessment techniques; shock associated noise in convergent nozzles; sound generation in turbulent shear flows; and instrumentation and signal analysis in aeroacoustics research were discussed. For individual titles, see N84-15026 through N84-15032.

N84-15026# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
RESEARCH TOWARDS AND DEVELOPMENT OF AEROSPACE VEHICLE NOISE CERTIFICATION WITH EMPHASIS ON PROPELLER AIRCRAFT AND HELICOPTERS
Hanno H. Heller *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 100 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

Noise certification of aerospace vehicles and the research necessary to develop appropriate noise standards are discussed. The ICAO specifications for controlling aircraft noise emission and immission (ANNEX 16 to the Convention on International Civil Aviation) are treated. Noise certification of heavy (commuter and transport) and light (sports and recreational) propeller driven airplanes and helicopters is outlined. Noise certification, data acquisition and evaluation are considered. Considerations towards changing, consolidating and improving the present schemes and procedures are assessed. Author (ESA)

N84-15027# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HELICOPTER NOISE c71
S. Lewy and M. Caplot *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 44 p refs Previously announced in IAA as A83-48195 (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

Helicopter turboshaft engine noise, especially rotor noise, is discussed. Physiological acoustics attempts to characterize helicopter noise effects due to the impulsive nature of main rotor acoustic emission are described. Experimental data are often contradictory, but solutions which remove the antitorque rotor are attractive. Although the tail rotor does not produce impulsive noise, acoustic level is comparable to the main rotor, and the sound has a higher, more disagreeable, frequency. Author (ESA)

N84-15028# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL METHODS IN COMPRESSOR NOISE STUDIES c71
S. Lewy and B. Jubelin (SNECMA, Moissy-Cramayel, France) *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 37 p refs Previously announced in IAA as A83-48194 (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

Resolution of sound wave equations in a guided medium, cut off properties of ducts, and azimuthal modes generated by a rotating source are discussed. Sound emission upstream of a compressor at subsonic and transonic speeds is compared. Ground-based and in flight measurement of compressor noise is described. A method of determining the spectrum of azimuthal or axial wave numbers by deriving the mean product of two signals filtered on a pure tone, one of which comes from a fixed microphone, and the other from a moving probe is illustrated.
Author (ESA)

N84-15029# Southampton Univ. (England). Inst. of Sound and Vibration Research.
A REVIEW OF SOURCE LOCATION/ASSESSMENT TECHNIQUES c71
M. J. Fisher and B. J. Tester (Rolls Royce Ltd., Derby, England) *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 26 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

Causality correlation, acoustic mirror, and far field microphone array techniques for investigating the relative contribution of each sound source to observed far field intensity are reviewed. The three microphone technique could separate core and jet noise at low frequencies, but viability above the duct cut off frequency is unclear. Acoustic mirrors are well established for model scale, but the necessary size for full scale investigations appears prohibitive. Microphone array methods are applicable at model or full scale. If used in the source image mode, care is necessary with microphone array design to provide adequately resolved source images without aliasing. Over a large frequency range, this can necessitate an excessive number of microphones. The parametric, automatic source breakdown, techniques ameliorate this problem, and yield source breakdowns at frequencies below that for which resolved source images can be obtained. Author (ESA)

N84-15030# Southampton Univ. (England). Inst. of Sound and Vibration Research.
SHOCK ASSOCIATED NOISE c71
M. J. Fisher *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 17 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

Noise produced by the shock cells observed in convergent nozzles as the pressure ratio exceeds a critical value is discussed. Discrete tone radiation (screech) results from a feedback mechanism between the shocks and the nozzle lip. Broad band

shock associated noise arises from turbulent eddies interacting with the shock cell structure to form an array of partially correlated sources. While a semiempirical model provides an adequate prediction scheme for most purposes, further theoretical work to explain the apparent spectral independence of the individual sources on jet velocity is needed. Author (ESA)

N84-15031*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERATION OF SOUND IN TURBULENT SHEAR FLOWS **c71**
Marvin E. Goldstein *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 72 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

An alternative to the Lighthill acoustic analogy for jet noise is discussed. It involves calculating the unsteady flow that produces the sound along with its resulting sound field starting from a prescribed upstream state that, ideally, is specified just ahead of the region where the sound generation takes place. Sound generation by turbulence interacting with solid obstacles is considered. It is shown that the process can be described by linear theory. Sound generated by turbulence interacting with itself is discussed. The processes are nonlinear and the theory is incomplete. Theories of sound generation are compared with experiment and the inadequacies of each are indicated. Additional mechanisms that appear at supersonic speeds are discussed. Author (ESA)

N84-15032# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INSTRUMENTATION AND SIGNAL ANALYSIS **c35**
G. Elias *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 14 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

Use of a single transducer to measure propeller aircraft flyover noise; and use of two transducers to obtain correlation coefficients for acoustic properties are described. Simultaneous use of many transducers is covered. A method to extract from a far field microphone the power spectral density associated with a component of a complex noise source is presented. A transducer located in the source area measures a parameter associated to a particuler noise source, s (t), and other fluctuations uncorrelated with s (t), that are considered as noise. A second transducer located near the first measures, with time delay, the same function s (t) and other fluctuations. Author (ESA)

N84-15033# Federal Aviation Administration, Washington, D.C. Office of Management Systems.
CENSUS OF US CIVIL AIRCRAFT. CALENDAR YEAR 1982 Annual Report
31 Dec. 1982 308 p
(AD-A133161; FAA-AMS-220) Avail: NTIS HC A14/MF A01 CSCL 01/3

This report presents information about the U.S. civil aircraft fleet. It includes detailed tables of air carrier aircraft and an inventory of registered aircraft by manufacturer and model, and general aviation aircraft by state and country of the owner. Author (GRA)

N84-15034# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
ADVANCED CONCEPTS FOR AVIONICS/WEAPON SYSTEM DESIGN, DEVELOPMENT AND INTEGRATION
Loughton Oct. 1983 484 p refs In ENGLISH and FRENCH Symp. held in Ottawa, 18-22 Apr. 1983
(AGARD-CP-343; ISBN-92-835-0337-6) Avail: NTIS HC A21/MF A01

New design and development strategies are considered to achieve the technical and performance benefits expected of highly advanced and integrated avionics/weapons system in an economic and timely manner. The applicable design and development concepts being considered are as follows: design of the overall system to satisfy the operational requirements; parallel design and development activities in relevant disciplines; retention of design and application flexibility and growth in subsystems by means of appropriate data processing and subsystem inter/intracommunications structure; planning of logistic support elements including reliability, maintainability and supportability as well as life cycle cost considerations; and comprehensive integrated ground testing prior to airborne evaluation of the weapons systems. For individual titles, see N84-15035 through N84-15075.

N84-15035# General Dynamics Corp., Fort Worth, Tex. Avionic Systems Dept.
SYSTEM ARCHITECTURE: KEY TO FUTURE AVIONICS CAPABILITIES **c06**
Gordon R. England *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 6 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Modern aircraft still rely, as old World War II aircraft, upon the pilot or crew for integration of information from diverse discrete subsystems, sensors and weapons. During this long period of technology time, each generation of systems has generally become more complex and increased the quantity and rate of information to the crew. In many weapon system implementations these two factors have resulted in increased problems in the areas of system availability, affordability, supportability and operability. Although the F-16 has broken this trend it is still evident that new system architectures will be needed as mission requirements in the future create added system demands. Traditional avionic design, support and operability approaches will be unable to cope. The size reduction and performance improvements resulting from large scale and high speed integrated circuits will make it possible to restructure the way avionics systems are designed. For example, standard modules for multiuse applications are possible. These modules become the building blocks for a new type of system architecture. Advanced data switching communication techniques provides the necessary data transfer rates to support sensor fusion, cockpit automation, and fault tolerant processing. Generic signal processors make shared functions realizable. Author

N84-15036# Westinghouse Electric Corp., Baltimore, Md. Defense and Electronics Center.
TACTICAL REQUIREMENTS IMPACT ON AVIONICS/WEAPON SYSTEM DESIGN **c06**
Thomas E. Spink and James F. Patton *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 15 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The complexity of tactical weapon delivery was greatly increased by the advent of new weapons, the enormity of enemy defenses and the awesome capability of new digital technology. However, careful assessment of the tactical requirements becomes even more important if a truly effective marriage of airframe, avionics and weapons is to be achieved. A review of a typical tactical mission requirement, battlefield interdiction, establishes a base for derivation of functional requirements on which an integrated attack system architecture is designed. The result is a need for a multisensor, multimode capability functionally integrated to achieve the flexibility required by the mission. Author

N84-15037# Northrop Corp., Hawthorne, Calif. Aircraft Div.
OPERATIONAL READINESS AND ITS IMPACT ON FIGHTER AVIONICS SYSTEM DESIGN **c06**
J. F. Irwin *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 11 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Operational Readiness (OR) is a widely used term that covers various aspects of availability, maintainability, reliability and testability. Just as the development of avionic systems require the establishment of system engineering, software design and interface

management guidelines, the same requirement exists for the world of operational readiness. These OR guidelines include the following controllable elements: design for testability (DFT), operational fault tolerance, system diagnostic reconfiguration, post flight data extraction/analysis, and integrated test and maintenance. Design and Acquisition of systems and prime electronic equipment must account for early consideration of testability and automatic test design requirements. Testability factors influence all phases of design, integration, deployment and support of electronic equipment and will adversely impact weapon system availability and ultimate return on investment if improperly specified and implemented. The major goals of fault tolerant systems are increased weapon systems availability, mission survivability, and an affordable life cycle cost. Widespread acceptance of operational readiness objectives will probably be predicated on the demonstrated life cycle cost of those initial aircraft containing fault tolerant systems. A managerial and technical roadmap for accomplishing the desired operational readiness goals in the next generation fighter is provided. The contribution of the various attributes (including testability, avionic architecture, fault tolerant designs, BIT, standardization and operational readiness control) is provided. Author

N84-15038# Naval Weapons Center, China Lake, Calif. Weapons and Tactics Analysis Center.

AVIONICS CONCEPT EVALUATION AT THE FORCE LEVEL **c06**

Miriam Cartwright and Terry Haven *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 7 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The development of new avionics systems should be guided and supported by force level analysis. Evaluation at the force level is necessary in order to assure that a concept, as it is conceived and developed, will indeed provide a significant increase in capability when the resulting weapon system is used in an operational environment. The Weapons and Tactics Analysis Center (WEPTAC) at the Naval Weapons Center is a war gaming facility for doing force level analysis. It is used to evaluate weapon systems and tactics as they would be employed in realistic scenarios involving opposing forces. It provides a valuable tool, therefore, for the evaluation of avionics concepts. The importance of force level analysis in avionics system development, describes the WEPTAC facility, and gives an example of the use of WEPTAC to evaluate an avionics concept is discussed. Author

N84-15039# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.

A FUTURE SYSTEM DESIGN TECHNIQUE BASED ON FUNCTIONAL DECOMPOSITION, SUPPORTED BY QUANTIFIABLE DESIGN AIMS, AND GUIDELINES FOR MINIMUM MAINTENANCE COSTS **c05**

D. Oldfield and L. T. J. Salmon *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 6 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The increasing cost and complexity of modern fast jet aircraft, coupled with the long development period which takes place while technology is changing rapidly, make it necessary to consider a new approach to system design. Such an approach should be based on a structured top down procedure, in which the rather general requirement can be changed into a detailed documented design in a controlled manner. One important aspect of design is cost, and in particular cost effectiveness and life cycle cost. At least some of the design aims are based on cost effectiveness reasoning, and it is necessary to have an appreciation of the background to this. Reliability dependent maintenance costs amount to much more than the original purchase price, and hence it is essential to be aware of the possible cost drivers, and include maintenance aspects in the design approach from the beginning. Author

N84-15040# Electronique Serge Dassault, St. Cloud (France).

TOWARDS A MODULARITY OF SOFTWARE CONCEIVED FOR THE REQUIREMENT OF THE USER [VERS UNE MODULARITE DU LOGICIEL CONCUE POUR LES BESOINS DE L'UTILISATEUR] **c05**

P. Catel *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 14 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Background data on software for the main computer of an avionics system is reviewed and the step taken at Dassualt in the search for modularity of software that is adapted to user needs is examined. This step evolved in two phases. The first phase concerned the median size (up to 64 K words) and permitted definition of a software structure and rules for cutting. The second phase appeared on the occasion of starting a new application, of more important volume, before becoming the base for an important family of applications. A study, led conjointly with the program specifier (the master work of the system), permitted different improvements, both on the plan of the structure as well as the methods for cutting, so as to obtain a perfect recovery of the entities of the software. This was concretized by the use of new tools and by extensions of the virtual machine of the computer used. A.R.H.

N84-15041# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Military Aircraft Div.

INCREASING SIGNIFICANCE OF ELECTROMAGNETIC EFFECTS IN MODERN AIRCRAFT DEVELOPMENT **c05**

D. Jseger *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 18 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Due to the use of new materials, the enlargement of the electromagnetic environment, the increasing susceptibility of electronic components and the rising dependence on satisfactorily functioning electronics, greater attention must be paid to electromagnetic effects in modern aircraft development. The increase in the scope of problems in comparison with the past and the possibilities which can be recommended for their solution are presented. Author

N84-15042# Naval Air Development Center, Warminster, Pa.

AVIONICS/CREW STATION INTEGRATION **c06**

William G. Mulley *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Advanced development concepts aimed at increasing the aircraft instrumentation performance for multiplatform applications of 1990's weapons systems are discussed. The objectives of these three areas are as follows: the system integration objectives are to produce a system architecture easily adaptable to many platforms; technology objectives are to determine the state of the art for displays, electronics, and controls; and the human factors objectives are to determine the proper human machine interfaces so that the ultimate crew station will be capable of providing the pilot with the proper display and controls performance to satisfy the diverse requirements of a fighter, attack, ASW, fixed wing, rotary wing, and V/STOL platforms in both a one man crew or two man crew matrix. All data/control interface among units of this crew station system and other platform subsystems are via digital data buses and video multiplex buses. No individual discrete signal, data, or control lines are needed. The six interfaces necessary to ensure the optimum development of this crew station, the predicted platform mission improvements, and the requisite life cycle cost considerations are discussed. This concept serves as a basis for planning the integation of the necessary hardware and software features in current and future weapons systems. Author

N84-15043# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

COMBINED VISUALIZATION [LE COMBINE DE VISUALISATION] **c06**

B. Simon *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Combined visualization corresponds to a mechanical ensemble uniquely regrouping a head up display and a head down display. The head up imagery is collimated and the head down imagery is either collimated or focalized on a fixed plane. Such a system permits a diversity of uses: (1) extending the visual field downward when the head down visualization is collimated; (2) reducing the head up symbology by a better division on the entire screen when the head down visualization is collimated; and (3) when the head down visualization is focalized at a fixed distance, it can be associated with another head down screen. A.R.H.

N84-15044# Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz (West Germany).
GUIDELINES AND CRITERIA FOR THE FUNCTIONAL INTEGRATION OF AVIONIC SYSTEMS WITH CREW MEMBERS IN COMMAND **c06**
Friederich W. Broecker *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 12 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Significant technical hardware advances were made during the past few years in digital-micro-technology that have caused problems of how to handle and how to use their great potential for the best benefit of designing a distinctly better system and working environment for the crew member in order to make him a real functional member of the system. Such a good approximation to a real functional integration of technical means and human beings seems to be the only promising way for a distinct improvement of weapon system effectiveness. Although the human member of the airborne system has not made at all comparable performance advances, he is increasingly used in a Superman role, required to integrate and monitor most of the subsystem, and thereby to compensate for the shortcomings and discrepancies of the total weapon system. Last but not least the primary job is to perform a mission in hostile environment. Author

N84-15045# Naval Weapons Center, China Lake, Calif.
NAVY'S ADVANCED AIRCRAFT ARMAMENT SYSTEM PROGRAM CONCEPT OBJECTIVES **c05**
T. M. Leese and J. F. Haney *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 17 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The Advanced Aircraft Armament System (AAAS) was originally chartered to improve armament equipment performance, support, and interoperability. Because of funding constraints the AAAS Program was increasingly directed to development of air armament interface standards and technology, while advanced concept development of suspension release and stores management equipment was de-emphasized. The current program concentrates on supporting the Joint Navy/Air Force Aircraft Armament Interface Program whose task is development of MIL-STD-1760 (Aircraft Electrical Interconnection System) and associated guidelines for successful application. Since the advanced concepts which were to be originally developed are a more appropriate subject, the context of the discussion is the program prior to the redirection. The Fleet needs and deficiencies which provided the requirements for the concept effort are briefly outlined, the objectives and goals are detailed, and the approach to achieve mission flexibility and performance improvements at reduced ownership costs is discussed. A key aspect of the approach is development of generic designs which capitalize on cost and growth advantages of standards while allowing incorporation of advancing technology.
Author

N84-15046# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
CONNECTING AIRCRAFT AND EXTERNAL LOADS [LIASONS AVION-CHARGES EXTREMES] **c05**
C. Connan and M. Saluan *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The evolution and complexity of so-called simple external loads (bombs) and the more important number of parameters demanded by complex loads (missiles, especially nacelles) makes the digitization of most material indispensable. The only other information left to connect is that pertaining to safety and large bandpass information. This information can be communicated as a function of the aircraft loads. For safety purposes, information authorizing the firing of weapons is not entirely digitized and is electrically segregated from other signals. The stanag 3837 project proposes a standardization of the electrical connections of external loads; however, it imposes the type of digital connection of the aircraft which is not necessary for interoperability: all securities are processed by doubling the numerical connection without any special connection. Architecture in existing aircraft or aircraft being developed or to be developed is discussed. Transl. by A.R.H.

N84-15047# Northrop Corp., Hawthorne, Calif. Aircraft Div.
TOWARDS THE FUNCTIONAL PARTITIONING OF HIGHLY INTEGRATED, FAULT TOLERANT AVIONICS SIGNAL PROCESSORS **c06**
J. A. Rey *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 12 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Avionics systems for new interdiction fighter aircraft require a high degree of integration, translated into automation for crew operations, of such formerly diverse subsystems of penetration, target acquisition, weapon delivery, threat detection and suppression and flight/propulsion control. Also coupled into this is the infusion of VHSIC/VSLIC. All this implies the need for a fault tolerant system to ensure flight safety and high operational ability. Some of the partitioning (configuration) issues involved in the integration process are discussed. Specifically, the issues involved with the functional partitioning into "generic" high speed signal processors and how this partitioning will cross some of the traditional interfaces between such things as flight control systems and avionics systems and subsystems within the avionic suite are addressed. Of special interest is the partitioning for sensor blending/data fusion/hi-speed data buses as pertains to terrain following/terrain avoidance function and how the critical path computations are made fault tolerant and/or allow for graceful degradation so that flight/mission safety is assured. Also discussed are the methods for computing reliability values based on these new configurations so that fault tolerant evaluations methods, such as the Markov process, may more realistically be computed.
Author

N84-15048# McDonnell Aircraft Co., St. Louis, Mo.
ADVANCED F/A-18 AVIONICS **c06**
R. C. Drummond and J. L. Looper *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The F/A-18 Hornet is a single seat, twin engine aircraft designed to fulfill fighter and light attack roles for the United States Navy and Marine Corps, and is being purchased by Canada, Australia and Spain. It has a very capable multimission weapon system, integrated so a single pilot can perform both fighter and attack missions. The challenge of multimission capability is to provide the necessary weapon system elements for effective air-to-air and air-to-surface weapons delivery without requiring a major flight line change each time the aircraft is reconfigured with armament. The answers for the multimission Hornet are digital technology and extensive system integration. High reliability, large scale integrated circuits and microprocessors are employed throughout the digital avionics suite. Integration among avionic subsystems is accomplished over the MIL-STD-1553A dual digital multiplex bus under control of two mission computers. The Hornet

has significant growth potential in addition to its present capabilities. Growth capacity includes spare computer memory, electrical power, cooling air and physical space. Author

N84-15049# Royal Aircraft Establishment, Farnborough (England).
DEF STAN 00-18: A FAMILY OF COMPATIBLE DIGITAL INTERFACE STANDARDS **c05**
D. R. Bracknell and A. A. Callaway *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 5 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Four data transmission standards published as parts of DEF STAN 00-18 are described. They constitute a compatible family of standards for avionic data transmission to meet the majority of current system requirements, and serve to focus both component and system development resources within the UK, to the benefit of both MOD and Industry. The guide to the use of the standards, future plans, and new options for standarization are discussed. M.G.

N84-15050# British Aerospace Aircraft Group, Brough (England). Avionics Development Engineering Dept.
TECHNIQUES FOR INTERBUS COMMUNICATION IN A MULTIBUS AVIONIC SYSTEM **c06**
W. H. Hall *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p ref (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

While studying the design of total aircraft systems using MIL-STD-1533 Data Buses the need for interbus communication protocols in multibus architectures was established. Two types of interbus communication were identified as necessary; cyclic message transfer and acryclic message transfers. Cyclic messages are handled by assigning specific subaddresses in the bus controller remote terminals which receive and pass on these messages to the appropriate destination on a cyclic basis as preprogrammed in the relevant bus controllers. Acyclic messages are handled by a special protocol based on the use of the service request bit in the status word, the transmit vector word mode code, a specially formulated vector word, special data words which are used as interbus transmit and interbus receive command words, together with the use of reserved subaddresses, one for each bus on the network. This protocol is explained in detail together with the measures taken in the subsystem to remote terminal interface to ensure orderly transmission of data and effective error recovery with lost or corrupt messages. Author

N84-15051# General Dynamics Corp., Fort Worth, Tex.
A VIDEO BUS FOR WEAPON SYSTEM INTEGRATION **c05**
P. L. Currier and W. E. Miles *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Military standard 1760, which defines the mechanical and electrical characteristics of the connector interface for new weapons, is described. As a joint Air Force/Navy standard, all new weapons will be required to be designed such that all command, control, and communication with those stores will occur through these pre-defined connector pins. Once an aircraft is built to meet the connector requirements, then any new weapon can be added by only changing the weapon delivery software. The problems an airframe manufacturer faces in adopting the standard are highlighted and the solution of one of these problems, viz, the video requirements of the standard, is examined. M.G.

N84-15052# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
NETWORK COMMUNICATIONS FOR A DISTRIBUTED AVIONICS SYSTEM **c06**
John C. Ostgaard and David A. Zann *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Due to the postulated 1990's threat environment advanced avionics architectures are experiencing demands for increased performance which have led, in part, to increased processing requirements and system complexity. As more processors are added to the control environment of sophisticated military aircraft, the choice of processor interconnection topology and methodology assumes greater importance. This choice profoundly influences information throughput, reliability, survivability and integrity throughout the weapon system. The ability to rapidly exchange/transfer information among processors and devices is critical if one is to develop a reliable, effective, communication system. Basic communication techniques which could serve as candidates in satisfying the network communication requirements of an advanced avionics architecture are addressed. Features of each technique are examined to ascertain the performance of these multi-access protocols in terms of developed system-driven criteria. Author

N84-15053# McDonnell Aircraft Co., St. Louis, Mo.
AVIONICS FAULT TREE ANALYZER **c06**
Michael E. Harris *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 15 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

McDonnell Douglas' F/A-18 aircraft allows use of a man-portable, microprocessor controlled, ground based test set to isolate avionic failures to the electronic card or shop replaceable assembly (SRA). Through a single existing connector on the aircraft, this Avionics Fault Tree Analyzer (AFTA) communicates, exercises, interrogates, and diagnoses the avionic subsystems. There are many instances when the AFTA not only isolates faults in the electronics but also in the aircraft wiring. Largely due to the truly distributive processing architecture of the aircraft and the modular design of the avionics, fault detection and isolation well beyond the weapon replaceable assembly (WRA) is achieved within milliseconds. Avionics as sophisticated as the flight control system, RADAR, and the stores management system are supported quickly and efficiently with electronics card replacement without intermediate level ground support facilities. The AFTA is currently a ground based device; however, the AFTA function will be incorporated in future aircraft. M.G.

N84-15054# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
FIRST LEVEL INTEGRATED MAINTENANCE IN WEAPONS SYSTEMS [MAINTENANCE PREMIER ECHELON INTEGREE DANS LES SYSTEMES D'ARMES] **c05**
M. E. L. Courtois *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The localization of replaceable entities in breakdown and the validation of functional chains are the two objectives of first level integrated maintenance that must be performed using only devices onboard modern combat aircraft. Integrated maintenance in a weapon system meets these imperatives by profiting from the technical evaluation of the equipment, the architecture of the weapon system, and the digital bus for the exchange of multiplexed information such as that used on the mirage 2000 aircraft. The principles of integrated maintenance, both on the ground and in-flight, are discussed. Transl. by A.R.H.

N84-15055# Concordia Univ., Montreal (Quebec).
COMPUTER GRAPHICS TECHNIQUES FOR AIRCRAFT EMC ANALYSIS AND DESIGN **c32**
S. J. Kubina (Defence Research Estab.) and P. Bhartia *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

A comprehensive computer-aided system for the prediction of the potential interaction between avionics systems, with special emphasis on antenna-to-antenna coupling, is described. The

methodology is applicable throughout the life cycle of an avionic/weapon system, including system upgrades and retrofits. As soon as aircraft geometry and preliminary systems information becomes available, the computer codes can be used to selectively display proposed antenna locations, emitter/receptor response characteristics, electromagnetic interference (EMI) margins and the actual ray-optical paths of maximum antenna-antenna coupling for each potential interacting antenna set. Antennas can be interactively relocated by track-ball (or joystick) and the analysis repeated at will for optimization or installation design study purposes. The codes can significantly simplify the task of the designer/analyst in effectively identifying critical interactions among an overwhelming large set of potential ones. In addition, it is an excellent design, development and analysis tool which simultaneously identifies both numerically and pictorially the EMI interdependencies among subsystems. M.G.

N84-15056# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Avionics Dept.
THE LOCK-ON-BEFORE-LAUNCH WEAPON DELIVERY AND DISPLAY/CONTROL CONSIDERATION c54
Klaus Boecking *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 15 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Investigations to provide basic test data to assess different methods of target acquisition and missile seeker aiming and lock-on are described. In addition, the pilot workload with different controls and displays was assessed and methods of reduction derived. Further different weapon information and weapon-video-display-systems and their advantages and disadvantages were investigated. The accuracy and speed of weapon aiming were especially evaluated. M.G.

N84-15057# British Aerospace Public Ltd. Co., Preston (England).
CASCADE: A DESIGN ENVIRONMENT FOR FUTURE AVIONIC SYSTEMS c06
A. O. Ward *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 18 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The design and development environment for software has grown from the basic needs of assembler to the wider requirements of higher order languages. The use of the latter has also witnessed a growing, but disparate, use of tools associated with the design process. Language standardization has presented the opportunity to produce powerful software development environments. Integrity and cost requirements will dictate the introduction of formal verification techniques to all levels of design and implementation. The use of VLSI/VHSIC technology and beyond will allow the designer to specify components and hence the design environment should be integrated with relevant CAD tools. These prospects are discussed and illustrated using a model of a Comprehensive Avionic System Computing Analysis and Design Environment, (CASCADE). Those features of CASCADE which exist today are described and its progress is charted in the medium and long term. Author

N84-15058# British Aerospace Public Ltd. Co., Preston (England). Aircraft Group.
A PRACTICAL APPROACH TO THE DESIGN OF A NEW AVIONIC SYSTEM c06
P. A. Duke *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 11 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

A program to design, construct and demonstrate an advanced avionic system for the next generation of tactical combat aircraft is described. The program has the prime objective of reducing the development risks associated with the rapid advance of technology. A number of factors contribute to this risk, notably the dramatic increase in system capability made possible by the general availability of LSI and VLSI circuitry. Traditionally independent systems can be linked using a data bus to provide a fully integrated system with the pilots needs foremost in mind. The system is based on a multi bus architecture recognizing the differing integrity requirements of different parts of the system. The avionic systems are linked to an advanced cockpit, with the objective of reducing pilot workload. The cockpit makes use of multi-purpose displays and an integrated approach to system control. A display of the out of cockpit scene is provided to allow the 'pilot' to operate the controls in a realistic manner and so provide representative input to the avionic system. The development is based on an evolutionary approach through a series of readily identifiable intermediate stages. Configuration control, procurement and management techniques are being developed in parallel with the avionic system itself. M.G.

N84-15059# General Dynamics Corp., Fort Worth, Tex.
INTEGRATION OF ICNIA INTO ADVANCED HIGH PERFORMANCE FIGHTER AIRCRAFT c06
Edward R. Conrad *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 8 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The incorporation of an integrated communications, navigation and identification avionics (ICNIA) system into modern high performance fighter aircraft is examined. To illustrate ICNIA interface with aircraft two types of avionics suites are considered. The first is an aircraft without an avionics multiplex interface, representing the older aircraft in service today. The second is an aircraft avionics suite with a dual multiplex bus interface such as is being designed today. M.G.

N84-15060# Operational Research and Analysis Establishment, Ottawa (Ontario). Directorate of Air Operational Research.
COMPUTER AIDED CONSTRUCTION OF GROUND ATTACK MISSION PROFILES OVER EUROPEAN TERRAIN c05
David W. Mason *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The optimization of an air-to-ground weapon inventory must investigate the trade-off between the effectiveness of the weapons and the vulnerability of the delivery aircraft to opposing ground defences while flying the mission profile required by the weapon. A computerized technique for constructing air-to-ground mission profiles in relation to actual terrain is described. The aim was to develop a profile construction system that permits the user to accurately but concisely direct the construction process. The technique relies on computer graphics to assist the user in creating realistic attack profiles. The system employs a data base of digitized central European terrain to produce perspective terrain image snapshots at key positions in the profile. Post analysis of the exposure history of a given profile will allow a reasonable assessment of the comparative survivability of an aircraft having to deliver weapon type A versus its survivability when delivering weapon type B. Although designed for use in weapon mix determinations for the Canadian Forces, this analysis tool may have useful applications in both aircraft design and air-to-ground weapon design for low level ground attack missions. M.G.

N84-15061# General Dynamics Corp., Fort Worth, Tex.
COLOR DISPLAY TECHNOLOGY IN ADVANCED FIGHTER COCKPITS c06
Kenneth E. Grosgebauer, William J. Wildman, and James A. Davis *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 8 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Over the past four years, the use of color-display technology in military aircraft has received a significant amount of attention; to date, the question of how to use color effectively has not been answered. With high-quality color cathode ray tubes (CRTs) now being manufactured in the United States, Japan, France, and England, additional questions concerning the display performance

requirements need to be answered prior to their introduction into the fighter cockpit. Weapon systems of today and those planned for the near term demand more effort from the pilot. A judicious application of color displays is considered to be one of the perequisites to overcome this additional workload. The selection process being applied to available color display technology, the flight simulator evaluations and some of the uses of color displays are discussed. As a result of simulator evaluations, future work will be directed toward optimizing color CRT technology and the use of color displays in the cockpit of advanced fighter/attack aircraft. Author

N84-15062# Aeritalia S.p.A., Caselle Torinese (Italy). Gruppo Sistemi Avionici ed Equipaggiamenti.
CRITICAL FACTORS AND OPERATIONAL RESEARCH IN TACTICAL FIGHTER AVIONIC SYSTEM DEVELOPMENT c06
L. Beradi *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The problem to design and to develop a complex system as a multiobjective optimization problem is considered. The avionic system of a tactical fighter is illustrated; assumptions and objectives of the project are listed. An approach to the problem that uses operations research tool and techniques, multiobjectives and marginal substitution rate functions is described. The method applied to the design and development of a tactical fighter avionic system is outlined. The expected characteristics, and the impact of implanned events on the system development are pointed out. Possible critical factors in the development process are emphasized by computation of the Marginal Substitution Rates. The operational mission software development for the avionic system is shown with attention to critical factors individuation. E.A.K.

N84-15063# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
AFTI/F-16: AN INTEGRATED SYSTEM APPROACH TO COMBAT AUTOMATION c05
Frank R. Swortzel and Willie S. Bennett, II (General Dynamics) *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 15 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The Advanced Fighter Technology Integration, AFTI/F-16 Program which was developed and flight validating advanced technologies which improve fighter lethality and survivability is discussed. The capability is achieved by the integration of mission task tailored, digital flight controls with a director type fire control system and advanced target sensor/trackers into an automated maneuvering attack system. The core technology in the AFTI/F-16 approach to this integrated system capability is the digital flight control system (DFCS). Integrated with the onboard avionics system, the DFCS provides capabilities for maximum exploitation of flight/fire/weapon control and other subsystem integration. Task automation as applied to the fighter mission is evaluated with AFTI/F-16's automated maneuvering attack system (AMAS). Radar and FLIR/Laser sensor/trackers provide precise targeting information in AMAS for both air to air and air to surface attack. The pilot/vehicle interface through multifunction displays, wide field of view HUD, predictive HUD symbology and hands on controllers are considered. Voice command is anticipated to be a key interface feature. The AMAS is expected to allow accurate weapon delivery from low altitudes (below 100m) while achieving increased survivability through maneuverability, the low altitude environment and standoff delivery. E.A.K.

N84-15064# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
CONCEPT OF A FIGHTER AIRCRAFT WEAPON DELIVERY SYSTEM c05
Reinald L. Rode *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 7 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Modern fighter aircraft which carry besides various types of bombs more and more intelligent weapons, are discussed. The development of a stores and missile management system must consider the requirement from the operational/tactical considerations and the optimal usage of advanced electronic equipment together with a growth and adaption capability in both areas. On the basis of existing weapon delivery systems some possible trends in weapon development and weapon control systems development are discussed. The integration problems of a complete aircraft weapon delivery system from the planning stage via equipment and subsystem development to rig and on aircraft testing up to first flight test experiences are also outlined. E.A.K.

N84-15065# Elektronik-System G.m.b.H., Munich (West Germany).
CADAS: A COMPUTER AIDED DESIGN TOOL FOR AVIONIC SYSTEMS c06
M. Burford, R. Cope, and H. Schneeweiss *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The development of CADAS - a computer aided design tool for avionic systems is outlined. Prior to outlining the basic concepts behind CADAS, an overview of present methods for validating software is presented. These concepts illustrate how certain key elements, such as the events language, the automatic generation and inclusion of models etc. were implemented. The objectives still to be achieved are presented. The need of such a general tool as a basic component of the programming support environment for embedded software is presented. E.A.K.

N84-15066# Boeing Military Airplane Development, Wichita, Kans.
DESIGN AND VERIFICATION OF ELECTROMAGNETIC COMPATIBILITY IN AIRBORNE WEAPONS SYSTEMS c32
Wesley R. Johnson *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 6 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

To achieve electromagnetic compatibility (EMC) among the electric, electronic and electromechanical systems in a complex airborne weapons system, the coordination of many engineering disciplines is required from concept to delivery. Often the primary objectives of structural, mechanical and electrical design are in direct conflict with good EMC practices. Interaction of the EMC organization requires a flexible management structure with hard line reporting within the EMC organization and soft line ties to the supported organizations. The major milestones required to achieve an electromagnetically compatible system are: (1) planning for EMC control; (2) analysis to highlight potential problem areas; (3) engineering evaluation tests to prove design concepts; (4) qualification testing of subsystems/equipments; (5) safety of flight testing on airplane to assure flight safety; and (6) system level EMC testing where safety margin demonstrations may be required. The steps required to accomplish the milestones and to assure that the weapon system will have a high probability of passing the final system level electromagnetic compatibility demonstration are discussed. E.A.K.

N84-15067*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN, DEVELOPMENT AND FLIGHT TEST OF A DEMONSTRATION ADVANCED AVIONICS SYSTEM c06
D. G. Denery, G. P. Callas, G. H. Hardy, and W. Nedell *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01 CSCL 01D

The design of integrated avionics suitable for general aviation was examined. The program emphasizes the use of data busing, distributed microprocessors, shared electronic displays and data entry devices, and improved functional capability. Design considera-

tions includes cost, reliability, maintainability, and modularity. A demonstration advanced avionics system (DAAS) was designed, built, and flight tested in a Cessna 402, twin engine, general aviation aircraft. The DAAS, and the system architecture are described.
E.A.K.

N84-15068# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
METHODS FOR DEVELOPING THE NAVIGATION AND WEAPON SYSTEMS OF THE MIRAGE 2000 [METHODES DE DEVELOPPEMENT DU SYSTEME DE NAVIGATION ET D'ARMEMENT DU MIRAGE 2000] **c04**
D. Boncorps *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The definition, completion, and mass production of a weapon system as complex as that of the Mirage 2000 aircraft poses numerous problems that are solved by direct collaboration among the French Official Service, the industry, and the user (French Air Force). This collaboration was concretized by the establishment of an industrial coordination body that is charged by Technical Services with establishing work dossiers which are then examined at different levels by all the interested parties. The association of recent work methods with sophisticated methods of development permits the definition of a complex system that conforms with the demands of users, with the least delay and at minimum cost.
A.R.H.

N84-15069# Naval Air Development Center, Warminster, Pa.
CREW STATION EVALUATION IN A DYNAMIC FLIGHT SIMULATION FACILITY **c09**
Jacob Eyth, Jr. *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The unique capabilities and design of the dynamic flight simulator and crew station evaluation facility as they pertain to avionics systems development and validation are described. This capability for preflight man in the loop evaluation of aircraft systems/subsystems during early phases of development diminishes the problems surfacing during flight tests and will ultimately reduce the cost and time required for operational deployment.
E.A.K.

N84-15070# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Military Aircraft Div.
CONCEPTS FOR AVIONIC AND WEAPON INTEGRATION FACILITIES **c09**
F. Kaestner *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 8 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The Tornado avionic and weapon integration facility is presented. The increased test capabilities are pointed out. Requirements for future integration concepts and the according ground test facilities are given.
E.A.K.

N84-15071# British Aerospace Public Ltd. Co., Preston (England).
HARDWARE-IN-THE-LOOP SIMULATION TECHNIQUES USED IN THE DEVELOPMENT OF THE SEA HARRIER AVIONIC SYSTEM **c06**
M. Mansell, W. J. Quinn, and C. J. Smith *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 17 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The use of simulation utilizing airborne hardware in the loop during the development of avionic systems is described. Each new weapon system, however, produces a different set of problems that usually requires a change of technique to satisfy the test requirements for the system. The Sea Harrier avionic system and the techniques used by British Aerospace in the development of this system are described. The special to type interfaces required to drive the forward looking radar, navigation system automatic flight control and HUD/weapon aiming computer are described.
E.A.K.

N84-15072# Northrop Corp., Hawthorne, Calif. Aircraft Div.
SIMULATION REQUIREMENTS TO SUPPORT THE DEVELOPMENT OF A FAULT TOLERANT AVIONIC SYSTEM **c06**
J. Shaw *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 11 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

The simulation package which was designed to support the development of fault tolerant avionic systems is presented. The Executive Support System, ESS, package which is presently used as a development, test and verification tool for F-5G and F-18L avionics models is described. The ESS provides an avionics system designer with a mechanism for developing and testing several avionic core configurations and develop avionic simulation and application modules.
E.A.K.

N84-15073# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
SOFTWARE TESTING OF SAFETY CRITICAL SYSTEMS **c03**
J. Stocker *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Safety critical systems must be thoroughly tested. Powerful test facilities and test concepts are very important. The methods used for testing the software of the Tornado Autopilot and flight director system (AFDS) are outlined and existing test systems are reviewed followed by a presentation of a new test facility i.e., the AFDS Cross Software Test System (AFDS-CSTS).
E.A.K.

N84-15074# Dowty Electronics Ltd., London (England).
AUTOMATING THE TESTING OF SOFTWARE **c61**
N. J. B. Young *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Continuing growth in the number of high integrity software based systems which cause a corresponding growth in the problems of software validation are discussed. A variety of validation techniques were examined but the problem of how to apply these in a practically useful, cost efficient, automated form is not resolved. Some available techniques against a concept of automatability are outlined and directions in which they can be improved for usefulness rather than for academic interest are identified. The symbolic execution techniques is presented. It is found that a reduction in routine testing costs by a factor of two to three, and other benefits, can be achieved in many cases.
E.A.K.

N84-15075# British Aerospace Public Ltd. Co., Preston (England). Aircraft Group.
A DYNAMIC APPROACH TO MILITARY AVIONICS SYSTEMS TESTING **c06**
R. A. C. Smith *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

Avionic systems development testing is outlined. The preflight ground test philosophy is based on the construction of an avionics systems development rig. The rig testing techniques were changed as the avionics systems increased in complexity and influence throughout the aircraft. The techniques presently employed are made possible due to two main factors: (1) the adoption of an integrated approach towards the use of and interaction between the avionics rig and other development facilities; (2) an increase in the use of computing for the data acquisition and simulation tasks. This has resulted in a shift in emphasis from static to dynamic system testing and the avionics development rig for the Tornado

F Mk 2 is capable of simulating flight. It is possible to exercise the avionics systems throughout the aircraft mission envelope on the rig before flight testing begins. The dynamic testing technique and its advantages form the basis for the Torndao F Mk 2 avionics rig facility and its operation. E.A.K.

N84-15076# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
FLIGHT MECHANICS AND SYSTEM DESIGN LESSONS FROM OPERATIONAL EXPERIENCE
Loughton Oct. 1983 344 p refs In ENGLISH and FRENCH Symp. held in Athens, 10-13 May 1983
(AGARD-CP-347; ISBN-92-835-0342-2) Avail: NTIS HC A15/MF A01

Lessons in design and safety learned from operational experience, incidents, and accidents are discussed. Flight data recording systems, adverse flight conditions, survivability after failure, and the man-machine interface are specifically addressed. For individual titles, see N84-15077 through N84-15102.

N84-15077# Army Safety Center, Fort Rucker, Ala.
INVESTIGATION, REPORTING AND ANALYSIS OF US ARMY AIRCRAFT ACCIDENT c03
M. J. Reeder, G. D. Lindsey, and D. S. Ricketson, Jr. *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 6 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Each year aircraft accidents result in large losses of US Army equipment and personnel resources. These losses are described in terms of aircraft and cause factors involved. Also presented is the system-oriented approach used in the investigation, reporting and analysis of these accidents. The results include identification of lessons learned with respect to cost, type aircraft, flight tasks, cause factors and system inadequacies which produced the cause factors. Author

N84-15078# National Aeronautical Establishment, Ottawa (Ontario). Flight Research Lab.
THE USE OF FLIGHT RECORDERS IN THE INVESTIGATION OF AIRCRAFT MISHAPS c03
Bernard Caiger *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 9 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Some problems encountered in the recovery of information from flight recorders for the investigation of aircraft mishaps are described. Techniques for rapid dissemination of the information to investigators are illustrated. Future developments in the design of voice and data recorders are discussed. Author

N84-15079# Civil Aviation Authority, Redhill (England). Airworthiness Div.
THE CIVIL AIRCRAFT AIRWORTHINESS DATA RECORDING PROGRAMME c35
H. D. Ruben *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 18 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The idea of operational flight data recording started with the continuous recording of just two parameters velocity V and normal acceleration. The value of information gained from these simple recorders encouraged improved recorders and their development is traced up to the high capacity digital recorders available today. The data recording program operated jointly by the CAA and the participating airlines has grown considerably over the 20 years of its existence. Its present organization and activities are described, and a number of examples of the analyses performed on the data are given to illustrate the wide range of areas in which the data is useful. Author

N84-15080# Flight Safety Foundation, Inc., Arlington, Va.
TWO DECADES OF AIR CARRIER JET OPERATION c05
Edward C. Wood and George P. Bates *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 7 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The accident record of the world fleet of air carrier jet aircraft from 1960 to 1981 is examined. Comparisons of total accidents, fatal accidents, and hull losses for this time period are reviewed against numbers of departures and hours flown. It is shown that there is a close correlation between fatal accidents and hull losses and that there has been a general stabilizing of the accident rate in the past decade of two to four accidents (hull losses) per million departures with the probability that, if no changes are introduced, this rate will remain essentially unchanged. Phases of operations where accidents have occurred are also examined, showing that over 50 percent of the fatal accidents have occurred during 14 percent of the operational exposure time spent in initial approach, final approach, and landing. Of this 50 percent, nearly 40 percent have occurred in the initial and final approach phases. The data indicate that airframe systems and powerplants, as well as maintenance air traffic control and weather factors have reached a high level of reliability and that the human factor is still the prevalent factor in the existing accident rates. Operator error has remained at over 70 percent. Since it is reasonably predictable that future accidents will occur in or near a major airport and will probably involve post crash fire, safety measures in this area are also discussed. M.G.

N84-15081*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INCIDENT REPORTING: ITS ROLE IN AVIATION SAFETY AND THE ACQUISITION OF HUMAN ERROR DATA c03
William D. Reynard *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 8 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The rationale for aviation incident reporting systems is presented and contrasted to some of the shortcomings of accident investigation procedures. The history of the United State's Aviation Safety Reporting System (ASRS) is outlined and the program's character explained. The planning elements that resulted in the ASRS program's voluntary, confidential, and non-punitive design are discussed. Immunity, from enforcement action and misuse of the volunteered data, is explained and evaluated. Report generation techniques and the ASRS data analysis process are described; in addition, examples of the ASRS program's output and accomplishments are detailed. Finally, the value of incident reporting for the acquisition of safety information, particularly human error data, is explored. M.G.

N84-15082# Air France, Paris. Service Securite et Analyse des Vols.
THE ANALYSIS OF RECORDS OF PARAMETERS: AN INDISPENSABLE TOOL IN OVERSIGHT AND IN OPERATIONS CONTROL [L'ANALYSE DES ENREGISTREMENTS DE PARAMETRES OUTIL INDISPENSABLE A LA SURVEILLANCE ET AU CONTROLE DE L'EXPLOITATION] c03
Jacques Gauthier *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 7 p In FRENCH (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The systematic analysis of flight by reading records of flight parameters has been practiced at Air France for nearly 10 years. The fundamental concepts of this policy are discussed as well as the means, methods, and philosophy which led to the establishment of the protocol. The rigorous application of this protocol resulted in the effective adherence and participation of the crew. Operating principles are described for the Commission of Flight Analysis, which is responsible for examining the most significant dossiers as well as for anonymous communication which is designed to gather from the crew any complementary information that is useful to the Commission. Some principle results obtained because of systematic flight analysis are included. Transl. by A.R.H.

N84-15083# Aeritalia S.p.A., Torino (Italy). Gruppo Velivoli da Combattimento.
FLIGHT PARAMETERS RECORDING FOR SAFETY MONITORING AND INVESTIGATIONS **c03**
E. Bertolina *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 11 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

A system for monitoring aircraft structural and engine parameters is discussed. The system adopts, as basic philosophy, an on board recording facility on each individual aircraft of all relevant flight and aircraft parameters and ground equipment performing two levels of analysis: (1) trouble shooting for structure, engine and systems limits exceedances or malfunctions after each flight during the normal turn around time giving a GO/NO GO indication for the next flight; and (2) a detailed calculation of fatigue loading experienced during each flight and the consequent residual life evaluation for the critical items, thus allowing the detailed monitoring of the usage of each aircraft. M.G.

N84-15084# Army Aviation Engineering Flight Activity, Edwards AFB, Calif. Flight Test Directorate.
ROTORCRAFT ICING TECHNOLOGY: AN UPDATE **c05**
R. Ward and H. W. Chambers (Army Aviation Research and Development Command, St. Louis, Mo.) *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 15 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Inflight icing tests for rotary wing aircraft are discussed. Topics specifically addressed include: (1) flight testing of pneumatic deice boots installed on a UH-1H helicopter in artificial icing conditions behind the Canadian NRC Ottawa Spray Rig; (2) artificial and natural icing tests of the unprotected CH-47C and UH-60A helicopter rotor systems; (3) evaluation of ice shapes on a UH-1H rotor system and hover performance degradation caused by rotor icing; and (4) current and planned improvements to the US Army JCH-47C Helicopter Icing Spray System (HISS). M.G.

N84-15085# Centre d'Essais en Vol, Istres (France). Service Essais.
AIRCRAFT OPERATIONS FROM AIRFIELDS WITH SPECIAL UNCONVENTIONAL CHARACTERISTICS **c05**
G. Robert *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 17 p refs In FRENCH (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Studies conducted by the General Directorate of Civil Aviation, assisted by the De Havilland Aircraft Company and users, resulted in the definition of procedures which assure a significant level of safety with regards to engine trouble at takeoff on the short runways used by TPP2 multimotor aircraft. Since authorization of use of these runways according to these procedures is very recent, it is premature to draw definitive conclusions on operational results. At present, the waiver granted concerns only the DHC6-300 aircraft; however, the recommendations formulated would be applicable to other types of aircraft providing complementary data is used concerning the minimal control of ground speed and performance of rolling at takeoff with engine trouble. Transl. by A.R.H.

N84-15086# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Dept. de Physique Generale.
A SYSTEMATIC CHARACTERIZATION OF THE EFFECTS OF ATMOSPHERIC ELECTRICITY ON THE OPERATIONAL CONDITIONS OF AIRCRAFT **c08**
Joseph Taillet *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 14 p In FRENCH; ENGLISH summary Original language document was announced as A83-48180 (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The effects of lightning and atmospheric static electricity on composite structures and digital controls is discussed. Flight trials were performed with instrumented aircraft to characterize and quantify the aircraft atmospheric electricity interactions, and to develop a data base that could eventually be used to ameliorate the effects of electromagnetic pulses. Static electricity can be coupled with the airframe by solid precipitation or by passage of the aircraft near an electrically charged cloud. Parasitic radioelectric signals gather on communications and navigation antennas, and are manifested in sparks, surface streamers, and coronal discharges. Coating with antistatic compounds and metallization can prevent the buildup of static charges. Lightning, however, can set off aircraft fuel, burst the radome, or kill the engines. Protective measures which include isolating and/or hardening the circuitry, reducing the collector loops surface for magnetic flux with twisted wires, and by replacing conductor data wiring by optoelectronic devices such as optic fibers, are outlined. E.A.K.

N84-15087# Royal Aircraft Establishment, Bedford (England).
WORLDWIDE EXPERIENCE OF WIND SHEAR DURING 1981-1982 **c47**
A. A. Woodfield and J. F. Woods *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 32 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Large changes of wind and downdraughts (Wind Shears) which have caused several major aircraft accidents are discussed. Wind shear data from over 9000 landings at 71 airports around the world during 1981 and 1982 were analyzed by discrete gust methods. Time histories of wind velocities and aircraft reactions are presented for 9 of the more interesting events identified. These were selected from 86 examples of large wind shears where the three components of wind velocity were calculated. An example of a severe downburst in the vicinity of a thunderstorm is presented. Statistics on the probabilities of encountering wind shears with particular patterns of headwind speed changes were calculated from the 9000 landings. Effects at different airports, height bands, shear lengths, and patterns are compared. Suggestions are made for Design Cases of shear that could be used for testing autopilots and wind shear measuring systems. Criteria for the severity of single ramp changes in headwind are presented. E.A.K.

N84-15088# Technische Univ., Brunswick (West Germany). Inst. for Flight Mechanics.
INFLUENCE OF WINDSHEAR ON FLIGHT SAFETY **c03**
G. Schaenzer *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 19 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Physical background characteristics of wind shear phenomena including adequate flight safety procedures to overcome the problems were analyzed. Wind shear during takeoff and landing may restrict flight safety. In some situations hazards may be caused by limited flight performance. In most cases wind shear accidents and incidents result from misunderstanding of the wind shear phenomenon by the pilot. A considerable number of wind shear accidents are interpreted wrongly as pilot error. Numerous investigations were made to solve the wind shear problem, however, failed because of failure to understand the physical phenomena. The problem is shown that some of the correct safety procedures in wind shear contradict the pilot's feeling of how to control an aircraft. E.A.K.

N84-15089# Ministry of Defence, London (England). Defence Science.
SOME COMMENTS ON THE HAZARDS ASSOCIATED WITH MANOEUVRING FLIGHT IN SEVERE TURBULENCE AT HIGH SPEED AND LOW ALTITUDE **c08**
J. Burnham *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 12 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The results of calculations made following several accidents and incidents during service training are described to show risks associated with severe turbulence during high speed maneuvering flight at low altitude. It does not imply that the phenomena are necessarily the cause of any particular accident or incident. Two

dangers are considered: a combination of gust and maneuver loads may be sufficiently high to cause structural failure, or that this combination may result in a stall or other departure from controlled flight from which recovery is impossible due to the proximity of the ground. High speed low level flight by military combat aircraft are examined. Such aircraft are capable of achieving and sustaining high maneuvering accelerations. This capability is used in terrain following, in maneuvering to take advantage of terrain screening. The existence of a possible problem area which appears to have received little attention in the past is indicated. E.A.K.

N84-15090# Army Research and Technology Labs., Fort Eustis, Va. Safety and Survivability Technical Area.
ARMY HELICOPTER CRASHWORTHINESS **c03**
C. Hudson Carper, LeRoy T. Burrows, and Kent F. Smith *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 17 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The evolution of crash survival design criteria, its influence on the formulation of a US army military standard for rotary wing aircraft crashworthiness, and its application to current and new generation army helicopters are discussed. The need for a total system's approach in design for crashworthiness and the necessity for considering crashworthiness early in the design phase of a new aviation weapon systems development effort is emphasized. The actual application of crashworthiness to army helicopters with statistics that show dramatic reductions in fatalities and injuries with implementation of a crashworthy fuel system are presented. Crash testing, human tolerance definition, improved energy absorbers, crew restraint systems, and crash impact characteristics of composite helicopter structures are discussed. Applicability of the work within Army helicopter crashworthiness to commercial/civil helicopters and the cost effectiveness of helicopter design to be more crash survivable are discussed. E.A.K.

N84-15091# Naval Air Test Center, Patuxent River, Md. Strike Aircraft Test Directorate.
THE IMPACT OF THE F/A-18 AIRCRAFT DIGITAL FLIGHT CONTROL SYSTEM AND DISPLAYS ON FLIGHT TESTING AND SAFETY **c08**
B. T. Kneeland, W. G. McNamara, and C. L. White *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 14 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The development of the digital fly by wire flight control system (FCS) in the F/A-18 aircraft is reviewed. A general description of the FCS and an overview of the significant changes that were incorporated to improve handling qualities and to correct anomalies that were discovered during the full scale development (FSD) program are presented. The interface of the FCS with the total avionics package of the F/A-18 via the 1553 multiplex bus and the impact of this interface on specific flight testing and FCS development is also highlighted. The impact of the flight control laws on high Angle of Attack (AOA) handling qualities, and the changes made is presented. The specialized displays and controls that are implemented in the F/A-18 to assist the pilot and enhance flight testing and safety are discussed. E.A.K.

N84-15092# General Dynamics Corp., Fort Worth, Tex. Flight Control Systems.
LESSONS LEARNED IN THE DEVELOPMENT OF THE F-16 FLIGHT CONTROL SYSTEM **c08**
Carl S. Droste *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 9 p (For primary document see N84-15076 06-01)
Copyright. Avail: NTIS HC A15/MF A01

Examples of several external factors which manifested themselves in the development of the F-16 and how the F-16 flight control system evolved to minimize their effect are discussed. External factors are pilot interface, ground maintenance, structural resonance, environmental conditions, indirect electrical hazards and other system failures. One of the most significant evolutions to aid in the isolation and resolution of problems is the time sequenced data provided by the F-16 maintenance memory. E.A.K.

N84-15093# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France). Dept. Equipements Dassault.
THE MIRAGE 2000: FLY BY WIRE CONTROL AND SAFETY [MIRAGE 2000: CDVE ET SECURITE] **c05**
J. Ladel and J. Bastidon *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 9 p In FRENCH (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The Mirage 2000 aircraft was built to provide the best efficiency in combat. To this end it uses electric flight control which permits a reasonable application of the generalized automatic control of the aircraft. Research on the safe operation of the piloting system led to a level of safety that is clearly superior to that observed on any previous aircraft. These performance and safety objectives were the subjects of theoretical and practical validations both in the laboratory and in flight in order to justify an a operational use of electric flight control. Transl. by A.R.H.

N84-15094# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
TORNADO AUTOPILOT MEASURES TO ENSURE SURVIVABILITY AFTER FAILURES **c08**
W. Schmidt and U. Butter *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 8 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Measures applied to the autopilot of the TORNADO to ensure survivability of the aircraft after failures during automatic low level flying are presented. Apart from redundant equipment, these measures include hardware and software limiters to minimize the effect of failures upon the aircraft, hardware and software monitors to detect and isolate failures, emergency procedures to initiate recovery maneuvers, as well as efficient testing of software. Author

N84-15095# Marconi Avionics Ltd., Rochester (England). Combat Aircraft Controls Div.
CERTIFICATION EXPERIENCE OF THE JAGUAR FLY-BY-WIRE DEMONSTRATOR AIRCRAFT INTEGRATED FLIGHT CONTROL SYSTEM **c08**
K. S. Snelling *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 19 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The digital Integrated Flight Control System (IFCS) is developed for the Jaguar Fly-By-Wire (FBW) demonstrator program, identifying the specification requirements, resultant architecture, implementation and the incorporated self test capability. The redundancy management aspect of the IFCS are described together with the techniques for providing the pilot with relevant information to determine the IFCS redundancy status. Particular emphasis is given to the software definition and preparation procedures, and the comprehensive integrity appraisal leading to flight clearance of the system. Following the extensive rig proving of the system, the early phases of flight test were very successfully carried out using the fixed gain control laws. During this period a major software update was commenced to incorporate the scheduled gain control laws and to enhance the self test capability. The software segregation introduced at this stage is described, together with the experience obtained in rectifying the system. Flight testing of the scheduled control laws is continuing, and the minor problems encountered are mentioned. A further software revision to include the control laws for the statically unstable aircraft is well advanced, and the benefits of software segregation identified during this revision are described. Author

N84-15096# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
THE MAN-MACHINE INTERFACE IN NEW GENERATION COMMERCIAL AIRCRAFT [L'INTERFACE HOMME - MACHINE DANS

LES AVIONS COMMERCIAUX DE LA NOUVELLE GENERATION] c54
Robert Galan *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 11 p In FRENCH (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The history of the man machine interface from the very beginning of aviation is reviewed and various trends for the last decade of this century are examined. A simple glance reveals that the style of relations between aircraft and their crews evolved in a profound way and that a spectacular leap has taken place over 80 yeas. Centralization, new generation instruments, cathode tubes, systems for flight management, display devices, and push button technology are explored. Transl. by A.R.H.

N84-15097# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Military Aircraft Div.
NEW FLIGHT DECK DESIGN IN THE LIGHT OF THE OPERATIONAL CAPABILITIES c05
R. Seifert and K. Brauser *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 13 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

The classification of human errors (H.E.) by category and conditions of occurence is presented. According to the conditions and causes of H.E. occurence different means of preventing H.E.'s by ergonomic design, by manning, selection and training are considered. In flight deck design, besides conventional ergonomic design, two strategies are proposed: (1) provision of sufficient feedback to allow the pilot to detect and correct unintentional performance errors before they affect system performance, and (2) Introduction of "fail safe and fail ops. ergonomic design" by means of H.E. detection and correction functions designed into the man-machine interface intelligence. The last generations of aircraft are compared regarding their task and system complexity. The increased complexity formed the need, and the advances in electronics provided the means for the new integrated flight deck, based on a cockpit data management system that includes "error monitoring capabilities". Finally the pilot's cockpit requirements of fire/flight control and post-stall-manoeuvring modes are discussed, requiring increased automation, information feedback loops and a "reconfiguration" of the pilot's task load. Author

N84-15098# British Aerospace Public Ltd. Co., Godalming (England).
MODERN FLIGHT INSTRUMENT DISPLAYS AS A MAJOR MILITARY AVIATION FLIGHT SAFETY WEAKNESS c06
J. F. Farley *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 3 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Consideration of the major causes of flying accidents over which the airframe and engine manufacturers can exert a powerful influence shows the following list: structural failure, engine failure, flying control failure, instrument failure, and pilot error. With the first three of these causes, Structural, Engine and Flying Control failures, while mistakes do occur, the manufacturers have a reasonable record, there is no evidence of complacency, and in addition there is a large well established, government controlled, national bureaucracy offering valuable checks and advice on testing and airworthiness certification. Pilot error in different, but appropriate ways, also attracts much effort aimed at its reduction. Most importantly, so far as the purposes of this paper are concerned, the accident trends related to the first three causes, as well as those due to pilot error, do not appear to have changed fundamentally during the last decade. The same cannot be said of instrument display related accidents. Since the advent of Head Up and computed displays in general, and the operator's real need to expand the non-visual maneuver envelope, there has been a marked increase in display related accidents/incidents in both operational and development flying. This note suggests that attempts at curing the problem have been based on a false assumption that has ignored the reality of the piloting task in modern high performance jet aircraft. Proposals are offered to improve the situation by both engineering and organizational changes. Author

N84-15099# Vliegbasis Volkel (Netherlands).
PHYSIOLOGICAL AND PSYCHOLOGICAL ASPECTS OF THE PILOTING OF MODERN HIGH-PERFORMANCE COMBAT AIRCRAFT c53
J. C. F. Aghina *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 3 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Since 1978 the Royal Netherlands Air Force has gained a lot of experience in handling a totally new aircraft, the F-16, which differs in many aspects from its predecessors. Not only the pilots, but the technicians too, had to adapt themselves to the new aircraft and they learned how to handle entirely new systems. The F-16 is a modern high performance fighter, like the F-4 and the F-15, and has caused problems for the pilots in comparison with former types, the F-104 and the NF-5. The extreme mobility of the aircraft produces not only a high gravity factor as such, but also a rapid G onset rate, by which a number of gravity depending physiological problems have arisen in a very obvious way. Furthermore, as a result of many technological innovations applied, i.e., aircraft's electronics, the pilot's task has also changed considerably, in particular with respect to the amount of information to be processed. The question arises of whether new approaches should be introduced into the selection, the physiological standards, the training, the supervision and the coaching of the operational pilots. Author

N84-15100# Royal Aircraft Establishment, Farnborough (England).
INCREASED AIRCRAFT SURVIVABILITY USING DIRECT VOICE INPUT c05
R. G. White and P. Beckett (British Aerospace PLC) *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 13 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

Direct Voice Input, a conventional keyboard and a touch-sensing display were compared as methods of en-route data entry during a simulated ground attack sortie. It was shown that when using Direct Voice Input the pilot looked inside the cockpit less frequently and for shorter periods and, when flying at very low level, was able to control height more accurately then when using either of the tactile systems. Contrary to expectation, the total entry times for a sequence of data and the times between entry of individual instructions and digits were long using Direct Voice Input than with either the keyboard or the touch-sensing display. This was attributed to the characteristics and performance of the isolated word recognizer used in the DVI system. A further simulator trial is planned, which will use a connected speech recognizer with a higher recognition performance. Author

N84-15101# Airbus Industrie, Blagnac (France). Flight Div.
CERTIFICATION EXPERIENCE WITH METHODS FOR MINIMUM CREW DEMONSTRATION c05
J. J. Speyer and A. Fort *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 31 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

AIRBUS INDUSTRIE's human factors involvement in flight test and certification with the double objective of checking functional effectiveness of the man-machine system and human welfare in its utilization process is discussed. The crew complement question prompted the consideration of workload for which Airworthiness Regulations provide a set of design-related, operational and human factors parameters. The rule on Minimum Flight Crew, FAA's FAR 25. 1523 and its Appendix D became effective in 1965 after an industry-wide consultation that included flight deck unions. This effectively coincided with the advent of the first two man crew commercial jet aircraft. The regulation called for an analysis and evaluation of the workload imposed upon the crewmembers of a

particular type of aircraft by its cockpit environment. This concern for workload stems from theory and experience that beyond some unacceptable threshold of workload a pilot's or a crew's performance will be degraded to unsafe levels and that the ability to cope with unexpected emergencies may be seriously impaired without the assistance of an extra crewmember. With the advent of today's new technology aircraft the crew complement question stirred such a controversy among US and European pilot unions tha the President of the United States himself set up a Task Force on aircraft crew complement. Author

N84-15102*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PILOT HUMAN FACTORS IN STALL/SPIN ACCIDENTS OF SUPERSONIC FIGHTER AIRCRAFT c54
Seth B. Anderson, Einar K. Enevoldson (NASA Dryden Flight Research Facility), and Luat T. Nguyen (NASA Langley Research Center) *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 10 p refs Document previously announced as N83-26856 (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

A study has been made of pilot human factors related to stall/spin accidents of supersonic fighter aircraft. The military specifications for flight at high angles of attack are examined. Several pilot human factors problems related to stall/spin are discussed. These problems include: (1) unsatisfactory nonvisual warning cues; (2) the inability of the pilot to quickly determine if the aircraft is spinning out of control, or to recognize the type of spin; (3) the inability of the pilot to decide on and implement the correct spin recovery technique; (4) the inability of the pilot to move, caused by high angular rotation; and (5) the tendency of pilots to wait too long in deciding to abandon the irrecoverable aircraft. Psycho-physiological phenomena influencin pilot's behavior in stall/spin situations include: (1) channelization of sensor inputs, (2) limitations in precisely controlling several muscular inputs, (3) inaccurate judgment of elapsed time, and (4) disorientation of vestibulo-ocular inputs. Results are given of pilot responses to all these problems in the F14A, F16/AB, and F/A-18A aircraft. The use of departure spin resistance and automatic spin prevention systems incorporated on recent supersonic fighters are discussed. These systems should help to improve the stall/spin accident record with some compromise in maneuverability. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N84-15103 Virginia Polytechnic Inst. and State Univ., Blacksburg.
COMPUTATIONAL AND EXPERIMENTAL STUDY OF TRAILING VORTICES Ph.D. Thesis
Heehwan Lee 1983 184 p
Avail: Univ. Microfilms Order No. DA8316881

A coordinated computational and experimental study was undertaken to investigate the behavior of the vortices trailing from low aspect ratio lifting surfaces. Vortex information in the near-wake was measured in a wind tunnel with yaw-head and hot-wire probes at three different Reynolds numbers, the highest of which was greater than most previous studies. These near-wake measurements provided initial conditions for the far-field computation with the parabolized Navier-Stokes equations written in terms of vorticity and stream function. Turbulent transport was modeled through the turbulent kinetic energy and the Prandtl-Kolmogorov hypothesis to give an eddy viscosity. The experimental results showed that the effects of Reynolds number are significant for vortex formation in the nearwake, and the computation adequately predicted these effects. However, the decay trend in the far-field is essentially unaffected by the Reynolds number, and the predicted decay for maximum tangential velocity agreed very well with Iversen's correlation. Dissert. Abstr.

N84-15104 Boston Univ., Mass.
NONLINEAR GREEN'S FUNCTION METHOD FOR TRANSONIC POTENTIAL FLOW Ph.D. Thesis
Kadin Tseng 1983 127 p
Avail: Univ. Microfilms Order No. DA8320018

A method for solving the nonlinear time dependent three dimensional aerodynamic potential equation using the Green's function method is presented. The Green's function method is being used to transform the partial differential equation into an integral-differential-delay equation. Finite-element and finite-difference methods are then employed for the spatial and time discretizations to approximate the integral equation by a system of differential-delay equations. Solving for this nonlinear simultaneous system of equations in time yields a solution to the Potential Equation. The nonlinear term in the differential equation determines the elliptic/hyperbolic nature of the equations. For the weakly nonlinear Small Disturbance Transonic Potential Equation, a type-dependent finite-difference approximation to the spatial derivatives of the nonlinear term is necessary to approximately represent the mixed elliptic/hyperbolic nature of the equation. Dissert. Abstr.

N84-15105 Arizona Univ., Tucson.
EFFECTS OF WALL INTERFERENCE ON UNSTEADY TRANSONIC FLOWS Ph.D. Thesis
Stanislaw Maciey Przybytkowski 1983 59 p
Avail: Univ. Microfilms Order No. DA8319730

Various sources of error can cause discrepancies among flight test results, experimental measurements and numerical predictions in the transonic regime. For unsteady flow, the effects of wind tunnel walls or a finite computational domain are the least understood and perhaps the most important. Although various techniques can be used in steady wind tunnel testing to minimize wall reflections, e.g., using slotted walls with ventilation, wind tunnel wall effects remain in unsteady wind tunnel testing even when they have been essentially eliminated from the steady flow. Even when the walls are ten chord lengths or more from the airfoil being tested, they can have a substantial effect on the unsteady aerodynamic response of the airfoil. Numerical computations of two and three dimensional unsteady transonic flow are compared with one another, and with experimental measurements, to isolate and examine the effects of tunnel walls. An extension of the time-linearized code developed by Fung, Yu and Seebass (1978) is used to obtain numerical results in two dimensions for comparison with one another. Dissert. Abstr.

N84-15106 Princeton Univ., N. J.
A STUDY OF HELICOPTER ROTOR AERODYNAMICS IN GROUND-EFFECT AT LOW SPEEDS Ph.D. Thesis
Mao Sun 1983 265 p
Avail: Univ. Microfilms Order No. DA8323886

An experimental and analytical study of helicopter rotor aerodynamics in ground effect at low speeds has been conducted. The experimental studies included flow visualization experiments and measurements of the mean induced velocity distribution near the rotor plane using the hot wire technique using a model rotor. When a lifting rotor operates near the ground at low speeds, its wake will roll up after impinging on the ground because of the effects of the ground and the free stream air flow. The flow field induced by the rolled-up wake influences the rotor aerodynamic properties significantly. When the rolled-up wake moves near to and under the rotor plane, very large and irregular variations of the induce velocity distribution in the forward part of the rotor will occur, as a function of the rotor advance ratio. This causes irregular variations of the rotor forces and moments that have been observed in previous experiments. A simplified free-wake-rolled-up-wake flow model was developed. Dissert. Abstr.

N84-15107 Michigan Univ., Ann Arbor.
NONLINEAR INVERSE PERTURBATION METHOD IN DYNAMIC REDESIGN Ph.D. Thesis
Ko Ook Kim 1983 121 p
Avail: Univ. Microfilms Order No. DA8324214

An analytical method is presented for automated redesign of undamped structures to achieve desired modal characteristics. The redesign involves a perturbation from a baseline design, and all nonlinear terms are carried so that large changes may be considered. The user specifies the frequency and mode shape changes. The method involves a single element analysis of the baseline structure. Design variables are expressed by structural parameters such as thickness, area, moment of inertia, etc. The perturbed elements are divided into a number of design groups through design variable linkage. Hence, the number of design variables can be reduced significantly. A penalty function method is used in which the original objective function is a minimum weight condition and the penalty term is a properly normalized set of residual errors in the equation of motion. The unconstrained minimization problem is solved using a conjugate gradient solver. For structural systems of small size, the nonlinear formulation using the equilibrium equation gives exact results even when the changes are large. Dissert. Abstr.

N84-15108 Oklahoma Univ., Norman.
OPTIMIZATION OF WAVERIDER CONFIGURATIONS GENERATED FROM NON-AXISYMMETRIC FLOWS PAST A NEARLY CIRCULAR CONE Ph.D. Thesis
Beom-Soo Kim 1983 124 p
Avail: Univ. Microfilms Order No. DA8324889

The optimum configurations of cone derived waveriders having maximum lift-to-drag ratios subject to a suitable constraint, such as fixed lift, are investigated. Analytic results from inviscid hypersonic small-disturbance theory for non-axisymmetric conical flow past a nearly circular cone are used, and results are valid for all values of K delta - M (infinity) delta, where delta is the semi-vertex angle of the basic circular cone. The special case of the configurations generated from axisymmetric conical flow is compared extensively with other configurations to give insight on the effects of the pertinent parameters. The inviscid analysis accounts for wave drag only, but the effect of viscous drag is discussed. The results are analytic in nature and particularly suitable for studying the various trade-offs that are involved in missile design. Comparison of the results with other types of lifting bodies suggest that properly selected waveriders are among the best producers of large lift-to-drag ratios. Dissert. Abstr.

N84-15109 California Inst. of Tech., Pasadena.
THE EFFECT OF FLOW OSCILLATIONS ON CAVITY DRAG, AND A TECHNIQUE FOR THEIR CONTROL Ph.D. Thesis
Morteza Gharib 1983 171 p
Avail: Univ. Microfilms Order No. DA8322670

The phenomenon of cavity flow oscillation is investigated to determine the conditions for onset of periodic oscillations and to understand the relationship between the state of the shear layer and the cavity dray. Experiments have been performed in a water tunnel using a 4 inch axisymmetric cavity model instrumented with a strip heater on the nose cone and pressure taps in and around the cavity. A complete set of measurements of oscillation phase, amplitude amplification along the flow direction, distribution of shear stress and other momentum flux is obtained by means of laser Doppler velocimeter. Drag measurements were made by integrating the mean pressure over the solid surfaces of the cavity. Results indicated exponential cavity drag dependence on the length of the cavity. A jump in the cavity drag coefficient is observed as the cavity flow shows a bluff body wake type behavior. An independent estimate of the drag, which is obtained by integration of shear and mean momentum transfer terms over the peripheral area of the cavity, confirms the exponential dependence of drag on the length of the cavity. Results, also reveal that the drag of the cavity in the nonoscillating mode is less than the case if the cavity were replaced by a solid surface. Dissert. Abstr.

N84-15110 Cornell Univ., Ithaca, N.Y.
A STUDY OF THE RETURN TO ISOTROPY OF HOMOGENEOUS TURBULENCE Ph.D. Thesis
Kwing-So Choi 1983 200 p
Avail: Univ. Microfilms Order No. DA8321877

Two kinds of homogeneous anisotropic turbulence were created by the plane distortion and the axi-symmetric expansion of grid-turbulence, and their return to isotropy was experimentally studied, using a constant-temperature hot-wire anemometer. The trajectories of the decaying anisotropic turbulence showed that the process of the return to isotropy was not linear, which gave experimental evidence that Rotta's linear model (Rotta, 1951) is not valid. To show the rate of the return to isotropy, a map of the characteristic time scale ratio of the turbulent kinetic energy decay to the return to isotropy was constructed for all possible anisotropic turbulence. This map showed that the rate of the return to isotropy was slower for turbulence with a larger third invariant (of the anisotropy tensor); this result confirmed the findings of Gence and Mathieu (1980). Based on these experimental results, a new turbulence model for the return-to-isotropy term in the Reynolds stress equation was constructed, using invariant modeling. Dissert. Abstr.

N84-15111 Cornell Univ., Ithaca, N.Y.
A LOWER-UPPER FACTORED IMPLICIT SCHEME FOR THE NUMERICAL SOLUTION OF THE EULER EQUATIONS APPLIED TO ARBITRARY CASCADES Ph.D. Thesis
Edward Kazimir Buratynski 1983 195 p
Avail: Univ. Microfilms Order No. DA8321799

A new implicit scheme for solving the Euler equations of inviscid flow has been implemented and tested. Derivation of the scheme initially follows that of the popular Alternating Direction Implicit (ADI) scheme. The principal difference between the two schemes lies in the form of the approximate factoring of the implicit operator. The LU factoring results in only two factors, independent of the spatial dimension of the problem. The two factors contain the opposite one sided difference operators for each spatial direction. Thus, the matrices contained in the factors are either lower (L) block diagonal or upper (U) block diagonal, and hence the name LU. Inversion of these block systems is relatively simple and efficient. It involves only the independent inversion of the individual main diagonal blocks which correponds to sweeping through the domain point by point. The precise form of the LU factoring is not unique, allowing choices of certain matrices. These choices are carefully made so as to yield factors whose corresponding matrices are diagonally dominant, thus ensuring numerical stability of the inversion procedure. Dissert. Abstr.

N84-15112 Michigan Univ., Ann Arbor.
ASYMPTOTIC THEORY OF AN UNSEPARATED SUPERSONIC TURBULENT BOUNDARY LAYER AT A COMPRESSION CORNER Ph.D. Thesis
Shreekant Agrawal 1983 187 p refs
Avail: Univ. Microfilms Order No. DA8324131

The interaction due to an unseparated supersonic turbulent boundary layer at a two dimensional compression corner is investigated using the method of matched asymptotic expansions for small values of the nondimensional friction velocity and of the flow turning angle. As in previous related studies, for most of the boundary layer the mean-flow properties in a first approximation are found to be described by the equations for inviscid rotational flow. In this outer part of the boundary layer, for a transverse length scale equal to the boundary-layer thickness, inviscid-flow solutions are derived in a supersonic, a hypersonic, and a transonic small-disturbance limit. Additional intermediate inviscid-flow solutions are derived in supersonic and transonic limits in order to describe the flow field at smaller distances from the corner. A composite solution for pressure is found from the outer and the intermediate supersonic and hypersonic inviscid-flow solutions. The results for wall pressure found from such a composite solution are in good agreement with experiment in most cases when the flow is unseparated. Dissert. Abstr.

N84-15113 National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
WIND TUNNEL TESTS ON A MODEL OF A SEMISUBMERSIBLE PLATFORM AND COMPARISON OF THE RESULTS WITH FULL-SCALE DATA
C. Leijnse and H. Boonstra (Marcon B. V.) 18 Mar. 1982 20 p refs Presented at 14th Ann. Offshore Technol. Conf., Houston, Texas, 3-6 May 1982
(NLR-MP-82014-U) Copyright. Avail: Issuing Activity

Forces and capsizing moments on the parts of an offshore platform above and below the water were studied using a wind tunnel model. Full scale anchorline force observations were compared with predictions. Theoretically calculated wind forces are 30% and 40% higher than forces obtained from wind tunnel tests. Theoretically calculated wind capsizing moments are not necessarily higher than moments derived from model tests. For the determination of capsizing moments in the free-floating condition, model tests on the underwater part are as important as tests on the part above water. The averages of forces obtained from full scale anchorline tensions are 25% lower than predicted from model test results. In the reduction of platform anemometer readings to undisturbed wind velocities at standard height, effects in the flow field around the structure, and the wind gradient should be taken into account. Maximum moments to be considered for a free floating platform may be reduced by considering the drift velocity of the platform. Author (ESA)

N84-15114*# General Dynamics Corp., Fort Worth, Tex.
TAS: A TRANSONIC AIRCRAFT/STORE FLOW FIELD PREDICTION CODE Final Report, Jul. 1982 - May 1983
D. S. Thompson Washington NASA Dec. 1983 59 p refs
(Contract NAS2-11277)
(NASA-CR-3721; NAS 1.26:3721) Avail: NTIS HC A04/MF A01 CSCL 01A

A numerical procedure has been developed that has the capability to predict the transonic flow field around an aircraft with an arbitrarily located, separated store. The TAS code, the product of a joint General Dynamics/NASA ARC/AFWAL research and development program, will serve as the basis for a comprehensive predictive method for aircraft with arbitrary store loadings. This report described the numerical procedures employed to simulate the flow field around a configuration of this type. The validity of TAS code predictions is established by comparison with existing experimental data. In addition, future areas of development of the code are outlined. A brief description of code utilization is also given in the Appendix. The aircraft/store configuration is simulated using a mesh embedding approach. The computational domain is discretized by three meshes: (1) a planform-oriented wing/body fine mesh, (2) a cylindrical store mesh, and (3) a global Cartesian crude mesh. This embedded mesh scheme enables simulation of stores with fins of arbitrary angular orientation. B.W.

N84-15115*# Grumman Aerospace Corp., Bethpage, N.Y.
A WING CONCEPT FOR SUPERSONIC MANEUVERING Final Report
William H. Mason Washington NASA Dec. 1983 79 p refs
(Contract NAS1-15357)
(NASA-CR-3763; NAS 1.26:3763) Avail: NTIS HC A05/MF A01 CSCL 01A

A theoretical and experimental program in which a wing concept for supersonic maneuvering was developed and then demonstrated experimentally in a series of wind tunnel tests is described. For the typical fighter wing, the problem of obtaining efficient lift at supersonic maneuvering C sub 's occurs due to development of a strong crossflow shock, and boundary layer separation. A natural means of achieving efficient supersonic maneuvering is based on controlling the non-linear inviscid crossflow on the wing in a manner analogous to the supercritical aerodynamic methods developed for transonic speeds. The application of supercritical aerodynamics to supersonic speeds is carried out using Supercritical Conical Camber (SC3). This report provides an aerodynamic analysis of the effort, with emphasis on wing design using non-linear aerodynamics. The substantial experimental data base is described in three separate wind tunnel reports, while two of the computer programs used in the work are also described in a separate report. Based on the development program it appears that a controlled supercritical crossflow can be obtained reliably on fighter-type wing planforms, with an associated drag due to lift reduction of about 20% projected using this concept. Author

N84-15116*# National Aeronautics and Space Administration, Washington, D. C.
WIND TUNNEL INVESTIGATIONS OF GLIDER FUSELAGES WITH DIFFERENT WAISTINGS AND WING ARRANGEMENTS
Rolf Radespiel Feb. 1983 16 p refs Transl. into ENGLISH of "Windkanaltersuchungen an Segelflugzeugruempfen Mit Verschiedener Einschuerung und Fluegelanordung" Akademische Fliegeruppe, (Braunschweig, West Germany), 1983 p 1-13 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Academic Aviation Group
(Contract NASw-3541)
Avail: NTIS HC A02/MF A01 CSCL 01A

The parameters fuselage pinch glider wing arrangement and fuselage leading edge radius of nine glider configurations were investigated in wind tunnel tests. Laminar separation bubbles were found on strongly recessed fuselages. These separations in the juncture between fuselage and wing are essential in the prevention of harmful aerodynamic drag. Drag reduction was measured with increasing pinch and the wing arrangement in the rear. These results are only valid for laminar flow on the fuselage leading edge. E.A.K.

N84-15117*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLOW IMPROVEMENTS IN THE CIRCUIT OF THE LANGLEY 4- BY 7-METER TUNNEL
Zachary T. Applin Dec. 1983 55 p refs
(NASA-TM-85662; L-15631; NAS 1.15:85662) Avail: NTIS HC A04/MF A01 CSCL 01A

The mean velocity profiles in both the horizontal and vertical planes of symmetry at specific locations throughout the tunnel circuit to identify the most promising means for improving the flow in the 4 by 7 meter wind tunnel were measured. In the base line tunnel flow surveys, the flow patterns near the end of the test section indicate a uniform mean velocity distribution. Downstream of the test section, unsymmetrical flow patterns result in low velocities along the inner walls and in flow separation along the inner wall of the diffuser upstream of the drive fan and along the outer wall of the large diffuser downstream of the drive fan. A set of trailing-edge flaps attached to the five flow-control vanes located just downstream of the first corner were installed. These flaps are successful in making the tunnel flow more symmetrical and in eliminating the regions of separation in the diffusers upstream and downstream of the drive fan. E.A.K.

N84-15118*# National Aeronautics and Space Administration, Washington, D. C.
THREE-DIMENSIONAL EFFECTS ON AIRFOILS
J. P. Chevallier Feb. 1983 45 p refs Transl. into ENGLISH of conf. paper ONERA-TP-1981-117 presented at the 18th Colloq. on Appl. Dyn., Association Aeronautique et Astronomie de France, 1981 p 1-34 Colloq. held in Chatillon, France, 18-20 Nov. 1981 Original language document was announced as A82-19734 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77025; NAS 1.15:77025; ONERA-TP-1981-117) Avail: NTIS HC A03/MF A01 CSCL 01A

The effects of boundary layer flows along the walls of wind tunnels were studied to validate the transfer of two dimensional calculations to three dimensional transonic flowfield calculations. Results from trials in various wind tunnels were examind to determine the effects of the wall boundary flow on the control surfaces of an airfoil. Models sliding along a groove in the wall of a channel at sub- and transonic speeds were examined, with the finding that with either nonuniformities in the groove, or even if the channel walls are uniform, the lateral boundary layer can cause

variations in the central flow region or alter the onset of shock at the transition point. Models for the effects in both turbulence and in the absence of turbulence are formulated, and it is noted that the characteristics of individual wind tunnels must be studied to quantify any existing three dimensional effects. Author

N84-15119*# National Aeronautics and Space Administration, Washington, D. C.
HELICOPTER BLADE TIPS
R. Lyothier Oct. 1983 28 p refs Transl. into ENGLISH of conf. paper NT-81-19 presented at the 18th Colloq. d'Aerodyn. Appl., 1981 23 p Colloq. held in Poitiers, France, 18-20 Nov. 1981 Original language document was announced as A83-11778 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77370; NAS 1.15:77370; NT-81-19) Avail: NTIS HC A03/MF A01 CSCL 01A

Methods of improving helicopter performance and vibration level by proper shaping of helicopter blade tips are considered. The principle involved consists of reducing the extent of the supersonic zone above the advancing tip and of the turbulent interaction. For stationary and advancing flight, the influence of the rotor and the problems posed by blade tips are reviewed. The theoretical methods of dealing with the two types of flight are briefly stated, and the experimental apparatus is described, including model triple and quadruple rotors. Different blade tip shapes are shown and briefly discussed. The theoretical results include an advancing speed of 309 km/H and a blade tip rotational speed of 215 m/s. The experimental values are advancing speed of 302 km/h and blade tip Mach number 0.86 for both types of rotors. Author

N84-15120*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOADS AND AEROELASTICITY DIVISION RESEARCH AND TECHNOLOGY ACCOMPLISHMENTS FOR FY 1982 AND PLANS FOR FY 1983
James E. Gardner Jan. 1984 167 p
(NASA-TM-84594; NAS 1.15:84594) Avail: NTIS HC A08/MF A01 CSCL 01A

Accomplishments of the past year and plans for the coming year are highlighted as they relate to five year plans and the objectives of the following technical areas: aerothermal loads; multidisciplinary analysis and optimization; unsteady aerodynamics; and configuration aeroelasticity. Areas of interest include thermal protection system concepts, active control, nonlinear aeroelastic analysis, aircraft aeroelasticity, and rotorcraft aeroelasticity and vibrations. A.R.H.

N84-15121# Grumman Aerospace Corp., Bethpage, N.Y.
MACH 0.6 TO 3.0 FLOWS OVER RECTANGULAR CAVITIES Final Report, Jun. 1978 - Jun. 1980
Louis G. Kaufman, II, Algirdas Maciulaitis, and Rodney L. Clark (AFWAL, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio AFWAL Mar. 1983 296 p refs Sponsored in part by AFWAL (AD-A134579; AFWAL-TR-82-312) Avail: NTIS HC A13/MF A01 CSCL 01/1

Internal weapons carriage in high performance aircraft is often adversely affected by the severe aeroacoustic environment produced with the weapons bay doors open. To obtain a better understanding of this fluid dynamic problem, basic static and oscillatory pressure data were obtained for Mach 0.6 to 3.0 flows over shallow rectangular cavities in a generic flat plate model. Cavity length to depth ratios were varied from approximately 5 to 10. Static pressure data characteristics of both open and closed cavity flows were obtained. An improved Rossiter method is presented that satisfactorily predicts the possibility frequency modes within the cavity. Highest fluctuating pressure occurs on the aft bulkhead, peaking near Mach 1.5 for the conditions tested. Aeroacoustic levels are substantially reduced by installing suppression fences (spoilers) at subsonic and low supersonic conditions. Acoustic levels generally drop rapidly above Mach 1.5. Author

N84-15122*# National Aeronautics and Space Administration, Washington, D. C.
FLOW MECHANISM AND EXPERIMENTAL INVESTIGATION OF A ROTATING STALL IN TRANSONIC COMPRESSORS
Lu Yajun and Zhang Shunlin Dec. 1983 21 p refs Transl. into ENGLISH from Acta Aeron. et Astronautical Sinica (China), v. 3, Jun. 1982 p 61-71 Original language document was announced as A82-45193 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3541)
(NASA-TM-77373; NAS 1.15:77373) Avail: NTIS HC A02/MF A01 CSCL 21E

The flow characteristics of the rotating stall in compressors is studied, and a flow model is developed along with a theoretical calculation method based on vortex theory. A detailed theoretical calculation is completed for a two dimensional flow field in a transonic rotor in a rotating stall, and the result is in good agreement with experimental findings. The oscillograms of time-varying stall characteristic parameters recorded for the onset, growth, and cessation processes of rotating stall are analyzed, and some new flow phenomena deserving of further investigation are discovered. These include serious separation of individual blades, often preceding the onset of rotating stall in compressors with very small blade-camber angles, and periodical variation of the circumferential width of the stall cell with time, accompanied by periodical oscillation of the width of the stall cell in the radial direction of the blade. The circumferential and radial oscillation frequencies are the same. C.D.

N84-15123*# Boeing Military Airplane Development, Seattle, Wash.
INLET FLOW FIELD INVESTIGATION. PART 1: TRANSONIC FLOW FIELD SURVEY Final Report
J. A. Yetter, V. Salemann, and M. B. Sussman Jan. 1984 122 p refs
(Contract NAS1-16612)
(NASA-CR-172239; NAS 1.26:172239; D180-27738-1) Avail: NTIS HC A06/MF A01 CSCL 01A

A wind tunnel investigation was conducted to determine the local inlet flow field characteristics of an advanced tactical supersonic cruise airplane. A data base for the development and validation of analytical codes directed at the analysis of inlet flow fields for advanced supersonic airplanes was established. Testing was conducted at the NASA-Langley 16-foot Transonic Tunnel at freestream Mach numbers of 0.6 to 1.20 and angles of attack from 0.0 to 10.0 degrees. Inlet flow field surveys were made at locations representative of wing (upper and lower surface) and forebody mounted inlet concepts. Results are presented in the form of local inlet flow field angle of attack, sideflow angle, and Mach number contours. Wing surface pressure distributions supplement the flow field data. Author

N84-15124*# National Aeronautics and Space Administration, Washington, D. C.
NEW INVESTIGATION OF SHORT WINGS WITH LATERAL JETS
E. Carafoli and N. Camarasescu Oct. 1983 19 p refs Transl. into ENGLISH from Stud. Cercet. Mec. Apl. (Romania), v. 29, no. 4, 1970 p 947-962 Previously announced as A70-42614 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3541)
(NASA-TM-77347; NAS 1.15:77347) Avail: NTIS HC A02/MF A01 CSCL 01A

The lift of short wings by means of lateral fluid jets fired in the plane of the wing in the direction of the span is described. After some theoretical considerations, the experimental results obtained in a wind tunnel on a series of wings of various lengths are presented. Author

N84-15125# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A MODEL OF THE TRAILING EDGE SEPARATION ON AN AIRFOIL Final Scientific Report, 15 May 1982 - 14 Feb. 1983

Greg Zilliac Feb. 1983 96 p refs
(Grant AF-AFOSR-0204-82; AF Proj. 2301)
(AD-A126703; EOARD-TR-83-7) Avail: NTIS HC A05/MF A01 CSCL 01/1

A model of the turbulent boundary layer separation of a two dimensional airfoil was investigated. The model consists of distributing sources on the contour in the separated region of sufficient strength to maintain the constant pressure characteristic of trailing edge boundary layer separation. A model for the attached boundary layer is included. An accurate estimation of maximum lift, pitching moment and pressure distribution was obtained. A correct drag prediction was not accomplished. Author

N84-15126# Air Force Academy, Colo.
WAKE CHARACTERISTICS AND INTERACTIONS OF THE CANARD/WING LIFTING SURFACE CONFIGURATION OF THE X-29 FORWARD-SWEPT WING FLIGHT DEMONSTRATOR Final Technical Note
K. E. Griffin, E. C. Haerter, and B. R. Smith 15 Aug. 1983 37 p
(AD-A133188; USAFA-TN-83-7) Avail: NTIS HC A03/MF A01 CSCL 20/4

This technical note summarizes experimental lifting-surface wake data taken from a 1/10-scale, reflection-plane a model of the X-29 Forward Swept Wing Demonstrator. The model is configured with and without the canard to illustrate the canard/wing wake interactions. The data collected comprises total, dynamic, and static pressures as well as local velocity magnitudes and directions for a series of points around this model. The data point are arrayed to include flow regions near the model as well as the freestream wake regions downstream of its canard and wing.
Author (GRA)

N84-15127# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMPUTATIONS OF PROJECTILE MAGNUS EFFECT AT TRANSONIC VELOCITIES Final Report
Charles J. Nietubicz, Walter B. Sturek, and Karen R. Heavey. Aug. 1983 32 p
(DA Proj. 1L1-61102-AH-43)
(AD-A133212; AD-F300314; ARBRL-TR-02515; ARBRL-IMR-74) Avail: NTIS HC A03/MF A01 CSCL 19/4

The Magnus effect has long been the nemesis of shell designers. Although very small in magnitude, on the order of 1/10th the normal force, this spin induced side moment has a significant destabilizing effect on projectiles. A combined computational and experimental research program has been ongoing at BRL in recent years to develop a predictive capability for the Magnus effect in particular and for projectile aerodynamics in general. This effort has been very successful in the supersonic regime. The research to be reported in this paper is an extension of this effort into the transonic regime. Utilizing the time marching, thin layer Navier-Stokes computational technique developed at NASA Ames Research Center, solutions have been obtained for a spinning, 6-caliber long, ogive-cylinder-boattail shape at Mach = 0.91 and angle of attack = 2 degrees. The computed results predict the correct development of the Magnus force along the body, and comparisons between the computation and experiment are very favorable. Details of the flow field solution such as turbulent boundary layer velocity profiles and surface pressure distributions are presented. The components which contribute to the Magnus effect are determined and presented as a function of axial position. A complete set of aerodynamic coefficients have been determined from the flow field solutions. Those to be presented here and compared with experimental data include the normal force and Magnus force coefficients. The computations for this research effort were obtained both on a CDC 7600 computer and Cray 1S. (etc.)
GRA

N84-15128# Sandia Labs., Albuquerque, N. Mex. Parachute Systems Div.
HIGH-SPEED, LOW-ALTITUDE PAYLOAD DELIVERY USING A SINGLE LARGE RIBBON PARACHUTE
D. W. Johnson and C. W. Peterson 1983 21 p refs Presented at the 8th AIAA Conf. on Aerodyn. Decelerator and Balloon Technol., Hyannis, Mass., 2 Apr. 1983
(Contract DE-AC04-76DP-00789)
(DE84-002731; SAND-83-2013C; CONF-8304129-1) Avail: NTIS HC A02/MF A01

A 46.3-ft-dia 20-degree conical ribbon parachute was designed to retard a 2200-lb payload delivered at speeds up to 800 KCAS and at altitudes as low as 150 feet above ground level. The parachute uses both Kevlar and nylon materials, some of which were developed specifically for this parachute. The canopy design incorporate a patented construction geometry to minimize stress concentrations. A cluster of three 3.8-ft-dia ribbon parachutes is used to deploy the main parachute in the presence of severe aircraft flow field effects and large payload angles of attack. The results of over 30 full-scale flight tests indicate that fundamental limitations imposed by the dynamics of the air masses inside and behind the canopy determine the ultimate performance of a single large parachute when it is used at a release altitude of 150 ft.
DOE

N84-15129# Sandia Labs., Albuquerque, N. Mex.
NEW, HIGH PERFORMANCE ROTATING PARACHUTE
W. B. Pepper, Jr. 1983 12 p refs Presented at 8th AIAA Conf. on Aerodyn. Decelerator and Balloon Technol., Hyannis, Mass., 2 Apr. 1983
(Contract DE-AC04-76DP-00789)
(DE84-002382; SAND-83-1636C; CONF-8304129-3) Avail: NTIS HC A02/MF A01

A new rotating parachute has been designed primarily for recovery of high performance reentry vehicles. Design and development/testing results are presented from low-speed wind tunnel testing, free-flight depolyments at transonic speeds and tests in a supersonic wind tunnel at Mach 2.0. Drag coefficients of 1.15 based on the 2-ft diameter of the rotor have been measured in the wind tunnel. Stability of the rotor is excellent. DOE

N84-15130# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain). seccion de instrumentos de a Bordo, Proteccion y Salvamento.
ICE FORMATION IN AIRCRAFT [FORMACION DE HIELO EN AVIONES]
Ernesto Montiel Rodriguez 1983 13 p refs In SPANISH
Avail: NTIS HC A02/MF A01

The wind velocity components around a bidimensional body are established for the case of no-lift and potential flow. An expression giving the drag coefficient of a sphere as a function of Reynolds numbers from 1 to 2000 is derived. Cloud parameters related to ice formation and types of ice are discussed. Mathematical expressions and research programs concerning ice formation are reviewed. Author (ESA)

N84-15131# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
COMPUTATIONAL PROCEDURES IN TRANSONIC AERODYNAMIC DESIGN
J. W. Slooff Apr. 1982 27 p refs Presented at Intern. Centre for Transportation Studies (ICTS) Short Course on Computational Meth. in Potential Aerodyn., Amalfi, Italy, 31 May - 5 Jun. 1982
(NLR-MP-82020-U) Avail: NTIS HC A03/MF A01

The hodograph, fictitious gas, inverse and numerical optimization approaches are discussed for transonic wing and airfoil design. It is suggested that if a general design method for complete wings is required neither the fictitious gas method nor the local residual-correction type of inverse approach are adequate. An inverse approach allowing global wing design as well as local design modifications is the best compromise, numerical optmization being too expensive. Author (ESA)

N84-15132# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
CALCULATION OF TRANSONIC FLOW AROUND TWO WING-FUSELAGE COMBINATIONS USING A FULL POTENTIAL EQUATION METHOD

Sven G. Hedman Jul. 1983 39 p refs
(Contract FMV-F-INK-82223-80-183-21-001)
(FFA-137; ISSN-SW-0081-5640) Avail: NTIS HC A03/MF A01; Aeronautical Research Institute of Sweden, Stockholm KR 70

A full potential finite volume method computed transonic flow around the FFA PT100 and the RAE Wing A Body 2. The solutions are performed in a C-type grid accurately fitting to wing and body. Results agree well with experimental values, but the method is fairly expensive in computer time and storage. Therefore, grids on the order of 80x24x20 meshes were used and only 60 or 90 iterations performed in these final grids. The convergence of higher Mach number cases is slow and may be nonexistent. Considerable patience and practice are required for successful execution of these cases. Author (ESA)

N84-15133 Stanford Univ., Calif.
AN EXPERIMENTAL STUDY OF AIRFOIL-SPOILER AERODYNAMICS Ph.D. Thesis
Blair George McLachlan 1983 104 p
Avail: Univ. Microfilms Order No. DA8320745

Results are presented from an experimental investigation of the steady/unsteady flow field generated by a typical two dimensional airfoil with a statistically deflected flap type spoiler. Subsonic wind tunnel tests were made over a range of parameters: spoiler deflection, angle of attack, and two Reynolds numbers (2.8 and 5.2 million) and involved comprehensive measurements of the mean and fluctuating surface pressures, velocities in the boundary layer, and velocities in the wake. Also, schlieren flow visualization of the near wake structure was performed. The mean lift, moment, and surface pressure characteristics are in agreement with previous investigations of spoiler aerodynamics. At large spoiler deflections, boundary layer character affects the static pressure distribution in the spoiler hingeline region; and, the wake mean velocity field reveals a closed region of reversed flow aft of the spoiler. Dissert. Abstr.

N84-15134 Stanford Univ., Calif.
AERODYNAMICS, AEROELASTICITY, AND STABILITY OF HANG GLIDERS Ph.D. Thesis
Ilan Mendel Kroo 1983 312 p
Avail: Univ. Microfilms Order No. DA8320735

Fundamental considerations relevant to the design and analysis of tailless gliders, controlled by center of gravity shifting, and simple methods for predicting the stability and performance of rigid hang gliders are presented. Results from a combined aerodynamic/structural analysis reflect the importance of flexibility which leads to several types of aeroelastic instability. Design features which reduce these effects and the potential for constructive aeroelastic design are discussed. Apparent mass and unsteady aerodynamic forces play an important role in the dynamics of very light aircraft as illustrated by an analysis of dynamic stability and control response. A number of problems unique to very low speed flight are identified. A wind tunnel investigation of elastically scaled models provides a means of verifying and extending this theoretical work. Results include the effects of various configuration modifications over a large range of flight conditions. Dissert. Abstr.

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N84-15135*# Structural Semantics, Palo Alto, Calif.
LINGUISTIC METHODOLOGY FOR THE ANALYSIS OF AVIATION ACCIDENTS
J. A. Goguen and C. Linde Dec. 1983 121 p refs
(Contract NAS2-11052)
(NASA-CR-3741; NAS 1.26:3741) Avail: NTIS HC A06/MF A01 CSCL 01C

A linguistic method for the analysis of small group discourse, was developed and the use of this method on transcripts of commercial air transpot accidents is demonstrated. The method identifies the discourse types that occur and determine their linguistic structure; it identifies significant linguistic variables based upon these structures or other linguistic concepts such as speech act and topic; it tests hypotheses that support significance and reliability of these variables; and it indicates the implications of the validated hypotheses. These implications fall into three categories: (1) to train crews to use more nearly optimal communication patterns; (2) to use linguistic variables as indices for aspects of crew performance such as attention; and (3) to provide guidelines for the design of aviation procedures and equipment, especially those that involve speech. E.A.K.

N84-15136# National Aeronautical Establishment, Ottawa (Ontario).
CAPABILITIES OF THE NRCC/NAE FLIGHT IMPACT SIMULATOR FACILITY
J. B. R. Heath, R. W. Gould, and G. R. Cowper May 1983 34 p refs
(AD-A130849; NAE-AN-13; NRC-21379) Avail: NTIS HC A03/MF A01 CSCL 01/B

This report describes the NRCC/NAE Flight Impact Facility in which birdstrike tests on aircraft parts can be carried out. Technical information is given on the capabilities of the pneumatic cannon used to fire real bird carcasses against stationary targets, and on the auxiliary apparatus and instrumentation available at the Facility. Author (GRA)

N84-15137# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
ELECTROFLUIDIC ANGULAR RATE SENSOR FOR EJECTION SEAT THRUST VECTOR CONTROL Final Report
D. R. Keyser Feb. 1983 70 p
(F41400000)
(AD-A133233; NADC-81189-60) Avail: NTIS HC A04/MF A01 CSCL 13/7

Three Hamilton Standard electrofluidic roll rate sensors were tested to measure their dynamic performance and their sensitivity to rotation about an orthogonal axis. An empirical dynamic mathematical model is derived for use in computer simulation of ejection seat dynamics. The test data are reported and evaluated. The data were used in part to develop a specification for a three-axis angular rate sensor intended for thrust vector control of an advanced escape system. The predominant dynamic response of this sensor is a transport delay of approximately 5 msec. Author (GRA)

N84-15138# Coast Guard Research and Development Center, Groton, Conn.
ANALYSIS OF US COAST GUARD HU-25A VISUAL AND RADAR DETECTION PERFORMANCE Interim Report, Feb. - Jun. 1983
H. G. Ketchen, L. Nash, and G. L. Hover Jun. 1983 85 p
(AD-A133380; CGR/DC-3/83; USCG-D-29-83) Avail: NTIS HC A05/MF A01 CSCL 06/7

During February 1983, the U.S. Coast Guard R/D Center conducted an experiment in Fort Pierce, FL, to evaluate the visual and forward-looking airborne radar (FLAR) detection performance of a new Coast Guard medium-range surveillance aircraft, the HU-25A. Visual searches were conducted for small (13- to 18-foot) boats, orange-canopied life rafts (4- to 6-man), and simulated persons in the water (PIWs). FLAR searches were conducted for small boats with and without radar reflectors and for the canopied life rafts. Target and aircraft positions were monitored with a computer-based microwave tracking system for detection/miss range reconstruction accurate to better than 0.1 nautical mile. The HU-25A was found to perform better as a visual search platform than other Coast Guard fixed-wing aircraft tested previously. Search speeds between 180 and 240 knots resulted in essentially uniform visual detection performance. The AN/APS-127 FLAR achieved cumulative detection probabilities between 11 and 50 percent in 1.5- to 4.5-foot seas and winds of 6 to

19 knots. Under these conditions, the FLAR system achieved initial detection ranges between 1.1 and 3.2 nautical miles. Recommendations are made for HU-25A search operations and future evaluations. Author (GRA)

N84-15073# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
SOFTWARE TESTING OF SAFETY CRITICAL SYSTEMS
J. Stocker *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15077# Army Safety Center, Fort Rucker, Ala.
INVESTIGATION, REPORTING AND ANALYSIS OF US ARMY AIRCRAFT ACCIDENT
M. J. Reeder, G. D. Lindsey, and D. S. Ricketson, Jr. *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 6 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15078# National Aeronautical Establishment, Ottawa (Ontario). Flight Research Lab.
THE USE OF FLIGHT RECORDERS IN THE INVESTIGATION OF AIRCRAFT MISHAPS
Bernard Caiger *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 9 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15081*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INCIDENT REPORTING: ITS ROLE IN AVIATION SAFETY AND THE ACQUISITION OF HUMAN ERROR DATA
William D. Reynard *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 8 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15082# Air France, Paris. Service Securite et Analyse des Vols.
THE ANALYSIS OF RECORDS OF PARAMETERS: AN INDISPENSABLE TOOL IN OVERSIGHT AND IN OPERATIONS CONTROL [L'ANALYSE DES ENREGISTREMENTS DE PARAMETRES OUTIL INDISPENSABLE A LA SURVEILLANCE ET AU CONTROLE DE L'EXPLOITATION]
Jacques Gauthier *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 7 p In FRENCH (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15083# Aeritalia S.p.A., Torino (Italy). Gruppo Velivoli da Combattimento.
FLIGHT PARAMETERS RECORDING FOR SAFETY MONITORING AND INVESTIGATIONS
E. Bertolina *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 11 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15088# Technische Univ., Brunswick (West Germany). Inst. for Flight Mechanics.
INFLUENCE OF WINDSHEAR ON FLIGHT SAFETY
G. Schaenzer *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 19 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15090# Army Research and Technology Labs., Fort Eustis, Va. Safety and Survivability Technical Area.
ARMY HELICOPTER CRASHWORTHINESS
C. Hudson Carper, LeRoy T. Burrows, and Kent F. Smith *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 17 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N84-15139# Federal Aviation Administration, Washington, D.C.
ADVANCED AUTOMATION PROGRAM. PROGRAM MASTER PLAN
21 Sep. 1983 51 p
(DOT/FAA/AP-83/3) Avail: NTIS HC A04/MF A01

The approach to be used for implementation of the Federal Aviation Administration advanced automation program is described in the program master plan. The program mission needs and objectives are described and the technical plan, management approach, acquisition strategy, contractor support program schedule, and funding plan for implementation of the program are described. The program document states FAA plans and policies for program execution. It will be supplemented by supporting documents that define the specific plans and mechanisms for program management, implementation, transition and control. E.A.K.

N84-15140# Naval Research Lab., Washington, D. C.
CONFIDENCE REGION FOR THE EVALUATION OF HF DF SINGLE SITE LOCATION SYSTEMS Interim Report
M. H. Reilly and J. Coran 2 Sep. 1983 22 p
(AD-A133208; AD-E000546; NRL-MR-5164) Avail: NTIS HC A02/MF A01 CSCL 17/3

A set of HF DF measurements in a single site location (SSL) system will yield after processing, a scatter of latitude longitude fixes of the position of a remote transmitter. A confidence ellipse associated with this distribution of fixes is defined and discussed for its applicability to SSL system evaluation. GRA

N84-15141# Federal Aviation Administration, Washington, D.C. Office of Aviation Policy and Plans.
ESTABLISHMENT AND DISCONTINUANCE CRITERIA FOR AIRPORT TRAFFIC CONTROL TOWERS Final Report
Susan Godby Helzer Aug. 1983 145 p
(AD-A133461; FAA-APO-83-2) Avail: NTIS HC A07/MF A01 CSCL 17/7

This report presents an economic analysis of VFR Airport Traffic Control Towers and criteria for tower establishment and discontinuance based on this analysis. Site-specific activity forecasts are used to develop tower benefits from prevented collisions between aircraft, other prevented accidents, and reduced flying time. Establishment costs include annual costs for staffing, maintenance, equipment, supplies and leased services and investment costs for facilities, equipment, and operational start up. The present value of tower benefits are compared with the present value of tower costs over a fifteen-year time frame. A location meets tower establishment criteria when the benefits which derive from operating the tower exceed the costs; a tower meets discontinuance criteria, when the costs of continued operation exceed the benefits. Applying the criteria to more than four-thousand airports, seventeen sites satisfy the benefit/cost criteria for tower establishment and fifty-five towers satisfy the benefit/cost criteria for discontinuance. These figures compare with twenty-five tower establishment candidates and forty-two tower discontinuance candidates under previous tower criteria. The sensitivity of the criteria results to several key assumptions is also examined. Author (GRA)

N84-15068# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
METHODS FOR DEVELOPING THE NAVIGATION AND WEAPON SYSTEMS OF THE MIRAGE 2000 [METHODES DE DEVELOPPEMENT DU SYSTEME DE NAVIGATION ET D'ARMEMENT DU MIRAGE 2000]
D. Boncorps *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N84-15142 Kansas Univ., Lawrence.
ANALYSIS OF NONPLANAR WING-TIP MOUNTED LIFTING SURFACES ON LOW-SPEED AIRPLANES Ph.D. Thesis
Cornelis P. G. D. vanDam 1983 187 p
Avail: Univ. Microfilms Order No. DA8317975

Nonplanar wing-tip-mounted lifting surfaces have shown to reduce lift-induced drag substantially. Winglets, which are small, nearly vertical, winglike surfaces, are an example of these devices. To achieve reduction in lift-induced drag, winglets produce significant side forces. Consequently, these surfaces can also seriously affect airplane lateral-directional aerodynamic characteristics. In this study, the effects of winglets on the lateral-directional stability and control of low-speed general aviation and agricultural airplanes are researched. In addition, winglet aerodynamic loading is investigated. A lifting surface method is used to conduct a paramotric study of the effects of various winglet parameters on lateral-directional stability derivatives of general aviation type wings. The results indicates that sideslip stability derivatives, in particular, are affected by the installation of winglets. Winglet chordwise location, sweep angle, and cant angle appear to provide design freedom to trade small reductions in induced drag for larger reductions in the stability of side force and rolling moment due to sideslip. Dissert. Abstr.

N84-15143*# National Aeronautics and Space Administration, Washington, D. C.
RECOGNIZING DEFECTS IN CARBON-FIBER REINFORCED PLASTICS
R. Schuetze and W. Hillger Sep. 1982 24 p refs Transl. into ENGLISH conf. paper DGLR-81-057 presented at the Deutsche Gesellschaft fuer Luft- und Raumfahrt Jahrestagung, 1981 p 1-20 Meeting held in Aachen, 11-14 May 1981 Original language document was announced as A81-47565 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-76947; NAS 1.15:76947; DGLR-81-057) Avail: NTIS HC A02/MF A01 CSCL 01C

The damage tolerance of structures made of carbon-fiber-reinforced plastic is tested under various loads. Test laminate (73/1/1, 24/9/1, 1465 A) specimens of thickness 1.5-3.2 mm with various defects were subjected to static and dynamic loads. Special attention was given to delamination, and ultrasonic C-scans were made on the specimens. It was shown that cracks from even small defects are detected with great accuracy. The same probes were also X rayed; defects that could not be detected under ordinary X rays were bored and studied under vacuum by a contrast technique. The nondestructive ultrasonic and X ray tests were controlled by partially destructive tests, and good agreement was observed. Author

N84-15144*# National Aeronautics and Space Administration, Washington, D. C.
FUEL ECONOMY IN AVIATION
Jeffrey L. Ethell 1983 117 p Original contains color illustrations (NASA-SP-462; NAS 1.21:462) Avail: NTIS MF A01; SOD HC $15.00 as 033-000-00899-6 CSCL 01C

Engine component improvement, an energy efficient engine, advanced turboprops, composite structures, energy efficient transport, and laminar flow control are discussed. N.W.

N84-15145*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN CONSIDERATIONS FOR REMOTELY PILOTED, HIGH-ALTITUDE AIRPLANES POWERED BY MICROWAVE ENERGY
Charles E. K. Morris, Jr. Jan. 1984 19 p refs Presented at the AIAA Appl. Aerodyn. Conf., Danvers, Mass., 13-15 Jul. 1983
(NASA-TM-85730; NAS 1.15:85730; AIAA-83-1825) Avail: NTIS HC A02/MF A01 CSCL 01C

Several types of systems have been considered in a design study of unmanned, microwave-powered, long-endurance, high-altitude airplanes. The study includes vehicles that use power from a continuously transmitted beam and other aircraft that receive intermittent power during cycles of boost-glide flight. Simple design algorithms are presented. Examples of sizing and performance analyses are used to suggest design-procedure guidelines. Author

N84-15146# Dayton Univ., Ohio.
FOD (FOREIGN OBJECT DAMAGE) GENERATION BY AIRCRAFT TIRES Final Report, Nov. 1981 - Oct. 1982
Stephan J. Bless, L. Cross, A. J. Piekutowski, and H. F. Swift Tyndall AFB, Fla. AFESC Aug. 1983 247 p
(Contract F08635-82-K-0102; AF Proj. 2104)
(AD-A133319; UDR-TR-82-136; AFESC/ESL-TR-82-47) Avail: NTIS HC A11/MF A01 CSCL 01/3

Lofting of loose debris by overrolling tires was investigated by experiments and analysis. Trajectories of lofted particles were determined with a stereoscopic camera system. Tire speeds ranged up to 40 mph; single-and dual-wheel carriages were used. Debris was mostly stones, 1 inch and smaller. Concrete and packed dirt surfaces, both wet and dry, were included. The probability of lofting a stone, given an encounter, was typically 15 percent, until the stone density exceeded one stone per footprint area; then the lofting probability was much less. Launch directions were mainly within 20 degrees of the direction defined by the wheel axle. Launch velocities were mainly less than 2.5 m/s. The probability of launching debris to above 4 was about 0.03. Angularity and size both increase lofting probability. Water did not greatly affect stone lofting, except for very small stones (6 mm). Extrapolations of these results to airfield scenarios predict that the danger of engine ingestion of nosewheel generated debris is minimal. The worst case considered was the F-4, which was less than 0.17 stones/km ingestion. These conclusions are based on extrapolations and need to be checked with experiments at higher tire speeds and loads. Author (GRA)

N84-15147# Aeronautical Research Labs., Melbourne (Australia).
REPORT ON VISIT TO THE US AND EUROPE IN MAY 1983, COVERING THE 1983 ICAF (INTERNATIONAL COMMITTEE ON AERONAUTICAL FATIGUE) MEETINGS AND RELATED VISITS Structures Technical Memo.
G. S. Jost Jul. 1983 110 p Meetings held in Toulouse, May 1983
(AD-A133415; ARL/STRUC-TM-362) Avail: NTIS HC A06/MF A01 CSCL 01/3

In May, 1983, the author made a number of fatigue-related technical visits in the US, and attended the 1983 meetings of the International Committee on Aeronautical Fatigue (ICAF) held in Toulouse, France. This report summarizes the matters considered during these visits. Author (GRA)

N84-15148# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
THE EFFECT OF SUPERPOSING RIPPLE LOADING OF MANEUVER LOAD CYCLES Final Report
M. S. Rosenfeld and P. Kozel Feb. 1983 47 p
(F41000)

(AD-A132653; NADC-81190-60) Avail: NTIS HC A03/MF A01 CSCL 14/2

An experimental investigation of the effect of superposing ripple loads on large amplitude cycles typical of aircraft maneuver loads is discussed. A range of valves intended to represent a severe case was selected. It was concluded that ripple load superposition reduces the constant amplitude fatigue life of 7075-T6 aluminum, but consistent, large life reductions were not apparent until ripple load amplitude exceeded 15% of the amplitude of the primary load cycles. Current methods of fatigue analysis which employ a local strain approach had a tendency to underpredict the magnitude of the ripple effect. R.J.F.

N84-15149# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

HELIX AND FELIX: LOADING STANDARDS FOR USE IN THE FATIGUE EVALUATION OF HELICOPTER ROTOR COMPONENTS

A. A. tenHave Aug. 1982 24 p refs Submitted for publication (NLR-MP-82041-U) Avail: NTIS HC A02/MF A01

Standardized fatigue test load histories for helicopter rotors are presented. Loading standards for fixed wing aircraft are described. Author (ESA)

N84-15039# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.

A FUTURE SYSTEM DESIGN TECHNIQUE BASED ON FUNCTIONAL DECOMPOSITION, SUPPORTED BY QUANTIFIABLE DESIGN AIMS, AND GUIDELINES FOR MINIMUM MAINTENANCE COSTS

D. Oldfield and L. T. J. Salmon *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 6 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15040# Electronique Serge Dassault, St. Cloud (France).

TOWARDS A MODULARITY OF SOFTWARE CONCEIVED FOR THE REQUIREMENT OF THE USER [VERS UNE MODULARITE DU LOGICIEL CONCUE POUR LES BESOINS DE L'UTILISATEUR]

P. Catel *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 14 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15041# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Military Aircraft Div.

INCREASING SIGNIFICANCE OF ELECTROMAGNETIC EFFECTS IN MODERN AIRCRAFT DEVELOPMENT

D. Jseger *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 18 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15045# Naval Weapons Center, China Lake, Calif.

NAVY'S ADVANCED AIRCRAFT ARMAMENT SYSTEM PROGRAM CONCEPT OBJECTIVES

T. M. Leese and J. F. Haney *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 17 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15046# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

CONNECTING AIRCRAFT AND EXTERNAL LOADS [LIASONS AVION-CHARGES EXTREMES]

C. Connan and M. Saluan *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15049# Royal Aircraft Establishment, Farnborough (England).

DEF STAN 00-18: A FAMILY OF COMPATIBLE DIGITAL INTERFACE STANDARDS

D. R. Bracknell and A. A. Callaway *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 5 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15051# General Dynamics Corp., Fort Worth, Tex.

A VIDEO BUS FOR WEAPON SYSTEM INTEGRATION

P. L. Currier and W. E. Miles *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15054# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

FIRST LEVEL INTEGRATED MAINTENANCE IN WEAPONS SYSTEMS [MAINTENANCE PREMIER ECHELON INTEGREE DANS LES SYSTEMES D'ARMES]

M. E. L. Courtois *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15060# Operational Research and Analysis Establishment, Ottawa (Ontario). Directorate of Air Operational Research.

COMPUTER AIDED CONSTRUCTION OF GROUND ATTACK MISSION PROFILES OVER EUROPEAN TERRAIN

David W. Mason *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15063# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

AFTI/F-16: AN INTEGRATED SYSTEM APPROACH TO COMBAT AUTOMATION

Frank R. Swortzel and Willie S. Bennett, II (General Dynamics) *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 15 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15064# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

CONCEPT OF A FIGHTER AIRCRAFT WEAPON DELIVERY SYSTEM

Reinald L. Rode *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 7 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15080# Flight Safety Foundation, Inc., Arlington, Va.

TWO DECADES OF AIR CARRIER JET OPERATION

Edward C. Wood and George P. Bates *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 7 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15084# Army Aviation Engineering Flight Activity, Edwards AFB, Calif. Flight Test Directorate.

ROTORCRAFT ICING TECHNOLOGY: AN UPDATE

R. Ward and H. W. Chambers (Army Aviation Research and Development Command, St. Louis, Mo.) *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 15 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15085# Centre d'Essais en Vol, Istres (France). Service Essais.

AIRCRAFT OPERATIONS FROM AIRFIELDS WITH SPECIAL UNCONVENTIONAL CHARACTERISTICS

G. Robert *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 17 p refs In FRENCH

(For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15093# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France). Dept. Equipements Dassault.
THE MIRAGE 2000: FLY BY WIRE CONTROL AND SAFETY [MIRAGE 2000: CDVE ET SECURITE]
J. Ladel and J. Bastidon *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 9 p In FRENCH (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15097# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Military Aircraft Div.
NEW FLIGHT DECK DESIGN IN THE LIGHT OF THE OPERATIONAL CAPABILITIES
R. Seifert and K. Brauser *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 13 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15100# Royal Aircraft Establishment, Farnborough (England).
INCREASED AIRCRAFT SURVIVABILITY USING DIRECT VOICE INPUT
R. G. White and P. Beckett (British Aerospace PLC) *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 13 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15101# Airbus Industrie, Blagnac (France). Flight Div.
CERTIFICATION EXPERIENCE WITH METHODS FOR MINIMUM CREW DEMONSTRATION
J. J. Speyer and A. Fort *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 31 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N84-15150# Battelle Columbus Labs., Ohio.
VALIDATION OF DIGITAL SYSTEMS IN AVIONICS AND FLIGHT CONTROL APPLICATIONS HANDBOOK, VOLUME 1 Draft Report, Jun. 1981 - Jul. 1982
Ellis F. Hitt, Jeff Webb, Charles Lucius, Michael S. Bridgman, and Donald Eldredge Jul. 1983 356 p
(Contract DTFA03-81-C-00059)
(AD-A133222; FAA-CT-82-115-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 01/3

The purpose of this handbook is to identify techniques, methodologies, tools, and procedures in a systems context that may be applicable to aspects of the validation and certification of digital systems at specific times in the development and certification portion of the system life cycle. The application of these techniques in the development of discrete units and/or systems will result in a completion of a product or system which is verifiable and can be validated in the context of the existing regulations/orders for the government regulatory agencies. The handbook uses a systems engineering approach to the integration and testing of software and hardware during the design, development, and implementation phases. The handbook also recognizes and provides for the evaluation of the pilot's workload and utilization of the new control/display technologies, especially when crew recognition and intervention may be necessary to cope with/recover from the effects of faults or failures in the digital systems. In summary, the handbook: (1) identifies and presents the issues related to design, development, and implementation of software based digital systems; (2) identifies specific approaches applicable to all aspects of the verification and validation procedures, at specific times in the development and certification portion of the system life cycle, (3) provides the government regulatory agencies (especially the Federal Aviation Administration (FAA) as well as the industry with a set of tools/procedures, in a systems engineering context which may be of value in the validation/certification process. GRA

N84-15035# General Dynamics Corp., Fort Worth, Tex. Avionic Systems Dept.
SYSTEM ARCHITECTURE: KEY TO FUTURE AVIONICS CAPABILITIES
Gordon R. England *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 6 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15036# Westinghouse Electric Corp., Baltimore, Md. Defense and Electronics Center.
TACTICAL REQUIREMENTS IMPACT ON AVIONICS/WEAPON SYSTEM DESIGN
Thomas E. Spink and James F. Patton *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 15 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15037# Northrop Corp., Hawthorne, Calif. Aircraft Div.
OPERATIONAL READINESS AND ITS IMPACT ON FIGHTER AVIONICS SYSTEM DESIGN
J. F. Irwin *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 11 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15038# Naval Weapons Center, China Lake, Calif. Weapons and Tactics Analysis Center.
AVIONICS CONCEPT EVALUATION AT THE FORCE LEVEL
Miriam Cartwright and Terry Haven *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 7 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15042# Naval Air Development Center, Warminster, Pa.
AVIONICS/CREW STATION INTEGRATION
William G. Mulley *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15043# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
COMBINED VISUALIZATION [LE COMBINE DE VISUALISATION]
B. Simon *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p In FRENCH (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15044# Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz (West Germany).
GUIDELINES AND CRITERIA FOR THE FUNCTIONAL INTEGRATION OF AVIONIC SYSTEMS WITH CREW MEMBERS IN COMMAND
Friederich W. Broecker *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 12 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15047# Northrop Corp., Hawthorne, Calif. Aircraft Div.
TOWARDS THE FUNCTIONAL PARTITIONING OF HIGHLY INTEGRATED, FAULT TOLERANT AVIONICS SIGNAL PROCESSORS

J. A. Rey *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 12 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15048# McDonnell Aircraft Co., St. Louis, Mo.
ADVANCED F/A-18 AVIONICS
R. C. Drummond and J. L. Looper *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15050# British Aerospace Aircraft Group, Brough (England). Avionics Development Engineering Dept.
TECHNIQUES FOR INTERBUS COMMUNICATION IN A MULTIBUS AVIONIC SYSTEM
W. H. Hall *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p ref (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15052# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
NETWORK COMMUNICATIONS FOR A DISTRIBUTED AVIONICS SYSTEM
John C. Ostgaard and David A. Zann *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15053# McDonnell Aircraft Co., St. Louis, Mo.
AVIONICS FAULT TREE ANALYZER
Michael E. Harris *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 15 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15057# British Aerospace Public Ltd. Co., Preston (England).
CASCADE: A DESIGN ENVIRONMENT FOR FUTURE AVIONIC SYSTEMS
A. O. Ward *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 18 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15058# British Aerospace Public Ltd. Co., Preston (England). Aircraft Group.
A PRACTICAL APPROACH TO THE DESIGN OF A NEW AVIONIC SYSTEM
P. A. Duke *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 11 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15059# General Dynamics Corp., Fort Worth, Tex.
INTEGRATION OF ICNIA INTO ADVANCED HIGH PERFORMANCE FIGHTER AIRCRAFT
Edward R. Conrad *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 8 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15061# General Dynamics Corp., Fort Worth, Tex.
COLOR DISPLAY TECHNOLOGY IN ADVANCED FIGHTER COCKPITS
Kenneth E. Grosgebauer, William J. Wildman, and James A. Davis *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 8 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15062# Aeritalia S.p.A., Caselle Torinese (Italy). Gruppo Sistemi Avionici ed Equipaggiamenti.
CRITICAL FACTORS AND OPERATIONAL RESEARCH IN TACTICAL FIGHTER AVIONIC SYSTEM DEVELOPMENT
L. Beradi *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15065# Elektronik-System G.m.b.H., Munich (West Germany).
CADAS: A COMPUTER AIDED DESIGN TOOL FOR AVIONIC SYSTEMS
M. Burford, R. Cope, and H. Schneeweiss *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15067*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN, DEVELOPMENT AND FLIGHT TEST OF A DEMONSTRATION ADVANCED AVIONICS SYSTEM
D. G. Denery, G. P. Callas, G. H. Hardy, and W. Nedell *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 10 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01 CSCL 01D

N84-15071# British Aerospace Public Ltd. Co., Preston (England).
HARDWARE-IN-THE-LOOP SIMULATION TECHNIQUES USED IN THE DEVELOPMENT OF THE SEA HARRIER AVIONIC SYSTEM
M. Mansell, W. J. Quinn, and C. J. Smith *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 17 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15072# Northrop Corp., Hawthorne, Calif. Aircraft Div.
SIMULATION REQUIREMENTS TO SUPPORT THE DEVELOPMENT OF A FAULT TOLERANT AVIONIC SYSTEM
J. Shaw *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 11 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15075# British Aerospace Public Ltd. Co., Preston (England). Aircraft Group.
A DYNAMIC APPROACH TO MILITARY AVIONICS SYSTEMS TESTING
R. A. C. Smith *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15098# British Aerospace Public Ltd. Co., Godalming (England).
MODERN FLIGHT INSTRUMENT DISPLAYS AS A MAJOR MILITARY AVIATION FLIGHT SAFETY WEAKNESS
J. F. Farley *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 3 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N84-15151*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

CLEAN CATALYTIC COMBUSTOR PROGRAM Final Report, Oct. 1979 - Jul. 1982

E. E. Ekstedt, T. F. Lyon, P. E. Sabla, and W. J. Dodds Nov. 1983 152 p refs

(Contract NAS3-22003)

(NASA-CR-168323; NAS 1.26:168323) Avail: NTIS HC A08/MF A01 CSCL 21E

A combustor program was conducted to evolve and to identify the technology needed for, and to establish the credibility of, using combustors with catalytic reactors in modern high-pressure-ratio aircraft turbine engines. Two selected catalytic combustor concepts were designed, fabricated, and evaluated. The combustors were sized for use in the NASA/General Electric Energy Efficient Engine (E3). One of the combustor designs was a basic parallel-staged double-annular combustor. The second design was also a parallel-staged combustor but employed reverse flow cannular catalytic reactors. Subcomponent tests of fuel injection systems and of catalytic reactors for use in the combustion system were also conducted. Very low-level pollutant emissions and excellent combustor performance were achieved. However, it was obvious from these tests that extensive development of fuel/air preparation systems and considerable advancement in the steady-state operating temperature capability of catalytic reactor materials will be required prior to the consideration of catalytic combustion systems for use in high-pressure-ratio aircraft turbine engines.

Author

N84-15152*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

AEROTHERMAL MODELING. EXECUTIVE SUMMARY Final Report

M. K. Kenworthy, S. M. Correa, and D. L. Burrus Dec. 1983 55 p refs

(Contract NAS3-23525)

(NASA-CR-168330; NAS 1.26:168330) Avail: NTIS HC A04/MF A01 CSCL 21E

One of the significant ways in which the performance level of aircraft turbine engines has been improved is by the use of advanced materials and cooling concepts that allow a significant increase in turbine inlet temperature level, with attendant thermodynamic cycle benefits. Further cycle improvements have been achieved with higher pressure ratio compressors. The higher turbine inlet temperatures and compressor pressure ratios with corresponding higher temperature cooling air has created a very hostile environment for the hot section components. To provide the technology needed to reduce the hot section maintenance costs, NASA has initiated the Hot Section Technology (HOST) program. One key element of this overall program is the Aerothermal Modeling Program. The overall objective of his program is to evolve and validate improved analysis methods for use in the design of aircraft turbine engine combustors. The use of such combustor analysis capabilities can be expected to provide significant improvement in the life and durability characteristics of both combustor and turbine components. B.W.

N84-15153*# Textron Bell Aerospace Co., Buffalo, N. Y.

NASTRAN DOCUMENTATION FOR FLUTTER ANALYSIS OF ADVANCED TURBOPROPELLERS Final Report

V. Elchuri, A. Michael Gallo, and S. C. Skalski Apr. 1982 216 p refs

(Contract NAS3-22533)

(NASA-CR-167927; NAS 1.26:167927; D2536-941010) Avail: NTIS HC A10/MF A01 CSCL 20K

An existing capability developed to conduct modal flutter analysis of tuned bladed-shrouded discs was modified to facilitate investigation of the subsonic unstalled flutter characteristics of advanced turbopropellers. The modifications pertain to the inclusion of oscillatory modal aerodynamic loads of blades with large (backward and forward) varying sweep. Author

N84-15154*# Textron Bell Aerospace Co., Buffalo, N. Y.

BLADED-SHROUDED-DISC AEROELASTIC ANALYSES: COMPUTER PROGRAM UPDATES IN NASTRAN LEVEL 17.7 Final Report

A. Michael Gallo, V. Elchuri, and S. C. Skalski Dec. 1981 348 p

(Contract NAS3-22533)

(NASA-CR-165428; NAS 1.26:165428; D2536-941006) Avail: NTIS HC A15/MF A01 CSCL 21E

In October 1979, a computer program based on the state-of-the-art compressor and structural technologies applied to bladed-shrouded-disc was developed. The program was more operational in NASTRAN Level 16. The bladed disc computer program was updated for operation in NASTRAN Level 17.7. The supersonic cascade unsteady aerodynamics routine UCAS, delivered as part of the NASTRAN Level 16 program was recorded to improve its execution time. These improvements are presented. Author

N84-15155*# General Electric Co., Cincinnati, Ohio. Advanced Technology Operation.

AEROTHERMAL MODELING, PHASE 1. VOLUME 1: MODEL ASSESSMENT Final Report

M. J. Kenworthy, S. M. Correa, and D. L. Burrus Nov. 1983 386 p refs 2 Vol.

(Contract NAS3-23525)

(NASA-CR-168296-Vol-1; NAS 1.26:168296-Vol-1) Avail: NTIS HC A17/MF A01 CSCL 21E

Phase 1 was conducted as part of the overall NASA Hot Section Technology (HOST) Program. The purpose of this effort was to determine the predictive accuracy of and the deficiencies within the various analytical modules comprising the overall combustor aerothermal model used at General Electric, as well as to formulate recommendations for improvement where needed. This effort involved the assembly of a benchmark quality data base from selected available literature, and from General Electric engine and combustor component test data. This data base was supplemented with additional definitive data obtained from an experimental test program conducted as part of the Phase 1 effort. Using selections from this data base, assessment studies were conducted to evaluate the various modules. Assessment of the internal flow module was conducted using 2-D parabolic and ellipitic, as well as 3-D elliptic internal flow calculations of definitive test data selected from the assembled data base. The 2-D assessment provided methodical examination of the mathematical techniques and the physical submodules, while the 3-D assessment focused on usefulness as a design tool. Calculations of combustor linear metal temperatures, pressure loss performance, and airflow distribution were performed using aerothermal modules which were in general use for many years at General Electric. The results of these assessment provided for the identification of deficiencies within the modules. The deficiencies were addressed in some detail providing a foundation on which to formulate a prioritized list of recommendations for improvement. Author

N84-15156*# General Electric Co., Cincinnati, Ohio. Advanced Technology Operation.

AEROTHERMAL MODELING, PHASE 1. VOLUME 2: EXPERIMENTAL DATA Final Report

M. J. Kenworthy, S. M. Correa, and D. L. Burrus Nov. 1983 161 p 2 Vol.

(Contract NAS3-23525)

(NASA-CR-168296-Vol-2; NAS 1.26:168296-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 21E

The experimental test effort is discussed. The test data are presented. The compilation is divided into sets representing each of the 18 experimental configurations tested. A detailed description of each configuration, and plots of the temperature difference ratio parameter or pattern factor parameter calculated from the test data are also provided. Author

N84-15157# DyTec Engineering, Inc., Long Beach, Calif.

STUDY OF NOISE-CERTIFICATION STANDARDS FOR AIRCRAFT ENGINES. VOLUME 1: NOISE-CONTROL TECHNOLOGY FOR TURBOFAN ENGINES Final Report

Alan H. Marsh Jun. 1983 51 p 3 Vol.
(Contract DOT-FA78WA-4096)
(AD-A133386; FAA/EE-82-11-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21/5

This study, reported in three volumes, had the purpose of considering the feasibility of establishing an FAA requirement for a manufacturer of aircraft engines to demonstrate compliance with an engine noise-level standard in order to obtain an engine noise type certificate. The objective of engine-noise type certification (if feasible on the basis of economic reasonableness, technological practicality, and appropriateness to the type design) would be to supplement the aircraft-noise type certification requirements in Part 36 of the Federal Aviation Regulations. The scope of the study was limited to aircraft turbofan engines. Volume 1 identifies sources of noise produced by aircraft turbofan engines, proposes a working definition of an engine's envelope within which an engine manufacturer may incorporate noise control design features, and evaluates applications of noise-control designs to 22 experimental and production versions of turbofan engines developed over a period from late 1950s to the mid 1970s and ranging in nominal take-off-rated thrust from 7.2 to 236 kN (1600 to 53 000 lb). A description is included of the general procedure for selecting appropriate noise-control designs applicable within the engine envelope for various sources of engine noise. GRA

N84-15158# DyTec Engineering, Inc., Long Beach, Calif.
STUDY OF NOISE-CERTIFICATION STANDARDS FOR AIRCRAFT ENGINES. VOLUME 2: PROCEDURES FOR MEASURING FAR FIELD SOUND PRESSURE LEVELS AROUND AN OUTDOOR JET-ENGINE TEST STAND Final Report
Alan H. Marsh Jun. 1983 88 p 3 Vol.
(Contract DOT-FA78WA-4096)
(AD-A133408; DYTEC-8204-Vol-2; FAA/EE-82-11-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 21/5

This study, reported in three volumes, had the purpose of considering the feasibility of establishing an FAA requirement for a manufacturer of aircraft engines to demonstrate compliance with an engine noise-level standard in order to obtain an engine-noise type certificate. The objective of engine-noise type certification would be to supplement the aircraft-noise type certification requirements in Part 36 of the Federal Aviation Regulations. The scope of the study was limited to aircraft turbofan engines. Volume 2 describes the general characteristics of 16 outdoor engine test stands used by 11 organizations for measurements of engine noise levels. Instruments and microphone installations are also described. Recommendations are presented for test procedures to measure farfield sound pressure levels around a turbofan engine mounted on an outdoor test stand. After adjusting the measured data to common reference conditions, the test results should be suitable for demonstrating compliance with the requirements for a static-engine noise type certificate. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N84-15159*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AFTI/F-16 FLIGHT TEST RESULTS AND LESSONS
Stephen D. Ishmael and Donald R. McMonagle Oct. 1983 30 p Presented at the 27th Symp. of the Soc. of Exptl. Test Pilots, Beverly Hills, Calif., 28 Sep. - 1 Oct. 1983
(NASA-TM-84920; NAS 1.15:84920; H1206) Avail: NTIS HC A03/MF A01 CSCL 01C

The advanced fighter technology integration (AFTI) F-16 aircraft is a highly complex digital flight control system integrated with advanced avionics and cockpit. The use of dissimilar backup modes if the primary system fails requires the designer to trade off system simplicity and capability. The tradeoff is evident in the AFTI/F-16 aircraft with its limited stability and fly by wire digital flight control systems when a generic software failure occurs the backup or normal mode must provide equivalent envelop protection during the transition to degraded flight control. The complexity of systems like the AFTI/F-16 system defines a second design issue, which is divided into two segments: (1) the effect on testing, (2) and the pilot's ability to act correctly in the limited time available for cockpit decisions. The large matrix of states possible with the AFTI/F-16 flight control system illustrates the difficulty of both testing the system and choosing real time pilot actions. The third generic issue is the possible reductions in the user's reliability expectations where false single channel information can be displayed at the pilot vehicle interface while the redundant set remains functional. E.A.K.

N84-15160# Hydraulic Research Textron, Valencia, Calif.
A STUDY OF DIGITALLY CONTROLLED FLIGHT CONTROL ACTUATION Final Technical Report, Aug. 1980 - Jun. 1983
Howard H. Belmont Wright-Patterson AFB, Ohio AFWAL Jul. 1983 152 p
(Contract F33615-80-C-3623; AF Proj. 2403)
(AD-A133274; AFWAL-TR-83-3041) Avail: NTIS HC A08/MF A01 CSCL 01/2

This report describes a study of flight control actuation system with an objective to determine the degree of digitalization possible between the digital flight control processor and the control surface. A typical analog actuation system is defined as a reference for comparison with five alternates, each mechanized with increasing amounts of digital equipment. The report provides a basis for determining the direction of digital actuation systems. It verifies that distributed actuation systems are now feasible and promise enhanced performance, reliability, and cost reductions. GRA

N84-15086# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Dept. de Physique Generale.
A SYSTEMATIC CHARACTERIZATION OF THE EFFECTS OF ATMOSPHERIC ELECTRICITY ON THE OPERATIONAL CONDITIONS OF AIRCRAFT
Joseph Taillet *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 14 p In FRENCH; ENGLISH summary Original language document was announced as A83-48180 (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15089# Ministry of Defence, London (England). Defence Science.
SOME COMMENTS ON THE HAZARDS ASSOCIATED WITH MANOEUVRING FLIGHT IN SEVERE TURBULENCE AT HIGH SPEED AND LOW ALTITUDE
J. Burnham *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 12 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15091# Naval Air Test Center, Patuxent River, Md. Strike Aircraft Test Directorate.
THE IMPACT OF THE F/A-18 AIRCRAFT DIGITAL FLIGHT CONTROL SYSTEM AND DISPLAYS ON FLIGHT TESTING AND SAFETY
B. T. Kneeland, W. G. McNamara, and C. L. White *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 14 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15092# General Dynamics Corp., Fort Worth, Tex. Flight Control Systems.
LESSONS LEARNED IN THE DEVELOPMENT OF THE F-16 FLIGHT CONTROL SYSTEM
Carl S. Droste *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 9 p (For primary document see N84-15076 06-01)
Copyright. Avail: NTIS HC A15/MF A01

N84-15094# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.
TORNADO AUTOPILOT MEASURES TO ENSURE SURVIVABILITY AFTER FAILURES
W. Schmidt and U. Butter *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 8 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15095# Marconi Avionics Ltd., Rochester (England). Combat Aircraft Controls Div.
CERTIFICATION EXPERIENCE OF THE JAGUAR FLY-BY-WIRE DEMONSTRATOR AIRCRAFT INTEGRATED FLIGHT CONTROL SYSTEM
K. S. Snelling *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 19 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N84-15161# Aktiebolaget Rollab, Stockholm (Sweden).
A QUASI-CONTINUOUS TRANSONIC WIND TUNNEL FOR CRYOGENIC OPERATION
Curt Nelander Nov. 1983 13 p
(ROLLAB-Memo-Rm-093) Avail: NTIS HC A02/MF A01

An alternative for driving a transonic or subsonic facility of medium to large size is described. The principle is to drive the fan in a closed circuit tunnel by using an air turbine fed by a high pressure air storage. The temperature rise imposed by the fan will be taken care of by introducing the cold outlet air from the turbine into the tunnel circuit. The same amount of air will be dumped to the atmosphere via a heat exchanger or matrix and thus cooling down the high pressure air. The stagnation enthalpy in the tunnel will be the same as the enthalpy of the driving gas in front of the turbine and the regeneration of the matrix accomplished by the temperature difference due to the Joule-Thomson effect. M.G.

N84-15162# Calspan Advanced Technology Center, Buffalo, N.Y.
RESULTS FROM WIND TUNNEL AND ARTIFICIAL RAINFALL TESTS OF THE MODIFIED SCAN SENSOR Interim Technical Report
T. M. Albrechcinski, E. J. Mack, and J. N. Kile Mar. 1983 23 p (Contract N00014-81-C-0443)
(AD-A133238) Avail: NTIS HC A02/MF A01 CSCL 01/5

Under contract for the Office of Naval Research, Calspan Corporation has been conducting an operational research investigation into the feasibility of utilizing the Surface Condition Analyzer (SCAN) system as an indicator of airport runway conditions. Specifically these efforts were: (1) to determine the ability of the SCAN System to measure runway water depth and (2) to assess the utility of such measurements in reducing aircraft hydroplaneing related problems at Naval airfields. The original sensors relied on a measure of the capacitance and conductivity of the water to which the water depth could be related. During field testing, it was determined that this approach was unsatisfactory in contaminated runway environments. In response to these findings, SSI devised a new sensor based on sonic principles, and in January 1983, prototypes of the new sensor were evaluated under wind and simulated rainfall test conditions in Calspan's Atmospheric Simulation Facility (ASF). This report briefly describes: the operation of the new device, the test facility, and the experiments. Data are presented to demonstrate the operation and performance of the SCAN sensor. Finally, conclusions regarding the potential utilization of a SCAN system to measure water depth in runway environments are given and recommendations for further evaluations are provided. GRA

N84-15163# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Flaechenflugzeuge.
FLYING QUALITIES EXPERIMENTS OF RATE COMMAND/ ATTITUDE HOLD SYSTEMS IN THE HFB 320 IN-FLIGHT SIMULATOR
Dietrich Hanke Jul. 1983 109 p
(DFVLR-FB-83-25) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 17

The technical implementation and flight experiments for handling qualities evaluation of a rate-command/attitude-hold system for pitch and roll axes using a sidegrip as pilot's control are described. The influence of maneuver enhancement by DLC, the influence of heading hold, and wing levelling functions were investigated. The HFB 320 in-flight simulator was used as the flight test vehicle. Overall system behavior was evaluated by two pilots in 85 instrument landing approaches. Pilot-vehicle performance was determined by measured aircraft state and performance parameters. Author (ESA)

N84-15069# Naval Air Development Center, Warminster, Pa.
CREW STATION EVALUATION IN A DYNAMIC FLIGHT SIMULATION FACILITY
Jacob Eyth, Jr. *In* AGARD Advanced Concepts for Avionics/ Weapon System Design, Develop. and Integration Oct. 1983 10 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15070# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Military Aircraft Div.
CONCEPTS FOR AVIONIC AND WEAPON INTEGRATION FACILITIES
F. Kaestner *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 8 p (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-16032*# Mississippi State Univ., State College. Dept. of Physics.
PRELIMINARY DESIGNS FOR MODIFICATIONS TO THE X-RAY SOURCE AND BEAM MONITOR OF THE MARSHALL SPACE FLIGHT CENTER'S X-RAY CALIBRATION FACILITY
W. L. Croft *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 21 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 14B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N84-15164*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DETROIT SPACE ODESSEY Final Report
Harrison Allen, Jr. [1983] 119 p Presented at the Aerospace Educational Symp. for the City of Detroit, 3-8 May 1982; sponsored in part by Detroit Public Schools and Wayne State Univ., Detroit (NASA-TM-85487; NAS 1.15:85487) Avail: NTIS HC A06/MF A01 CSCL 22A

The symposium included personal appearances by NASA astronauts, NASA exhibits, aerospace science lecture demonstrations (Spacemobile Lectures), and talks on job opportunities in aerospace and on the benefits of the Space Program. The program was directed mainly at (public, parochial and private) student groups, each of which spent three hours at the symposium site, Wayne State University campus, to participate in the symposium

activities. The symposium was open to the general public and consisted of the NASA exhibits, aerospace science lecture demonstrations, films, talks on the benefits of the space program, and a special tasting demonstration of "space food" meal systems. Author

N84-15165*# Brown (W. S.), Inc., Salt Lake City, Utah.
COMMERCIALIZATION OF OPPORTUNITIES FOR MATERIALS PROCESSING IN LOW GRAVITY Final Report
Wayne S. Brown and S. Reed Nixon 13 Jun. 1983 35 p
(Contract NAS8-34901)
(NASA-CR-170953; NAS 1.26:170953) Avail: NTIS HC A03/MF A01 CSCL 22A

Business infrastructure required to achieve commercial MPS, incentives and disincentives for MPS, NASA/industry working agreements, small business innovation, NASA/industry agreements, joint venture agreements, and commercial spinoffs are addressed. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N84-15166 California Inst. of Tech., Pasadena.
OPTIMAL LOW THRUST, THREE BURN ORBIT TRANSFERS WITH LARGE PLANE CHANGES Ph.D. Thesis
Keith Peter Zondervan 1983 120 p
Avail: Univ. Microfilms Order No. DA8322675

During the last twenty years, much attention has been devoted to the problem of optimal orbit transfers. The problem has been conveniently divided into two categories - unlimited thrust (or acceleration) orbit transfers and limited thrust (or acceleration) orbit transfers. The unlimited thrust orbit transfers use infinite thrust, zero burn time burns and hence have also come to be known as impulsive burn orbit transfers. In general it has been found that optimal (i.e., minimum fuel time free) solutions to these types of transfers require two or possibly three burns. The limited thrust transfers, in contrast, do not use impulsive burns but use burns which have a finite thrust level and a nonzero burn time and hence, are also known as finite burn orbit transfers. This study is restricted to finite multiburn transfers which have burn times less than an orbital period, two classes of transfers emerge. These classes of transfers are either Geometrically Similar to the 2-Burn Impulsive (GS2B) transfers or Geometrically Similar to the 3-Burn Impulsive (GS3B) transfers. Dissert. Abstr.

N84-15167 Stanford Univ., Calif.
THREE-DIMENSIONAL, PERIODIC HALO ORBITS IN THE RESTRICTED THREE-BODY PROBLEM Ph.D. Thesis
Kathleen Ann Connor Howell 1983 141 p
Avail: Univ. Microfilms Order No. DA8320724

In the circular restricted three body problem, three dimensional, periodic orbits for the infinitesimal body exist that emanate from the general vicinity of the three collinear libration points. A numerical study was done to investigate the dependence of these orbits on mu, the mass ratio of the two primary bodies families containing stable three dimensional orbits were found to exist near the two exterior libration points for all values of mu, and that the size of these orbits increases with mu. Near the interior libration point, stable orbits exist only for mu $<$ .0573. Following a family toward the nearer primary, the orbits become thin and almost rectilinear, aligned essentially perpendicular to the plane of motion of the primaries. These near-collision orbits can be calculated and their stability analyzed by regularized numerical integration using a transformation of variables or by using 1st or 2nd order expansions in the small in-plane components of angular momentum, relative to the nearer primary, and of the osculating Laplace eccentricity vector. Dissert. Abstr.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N84-15168*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JPL CLOSEUP
1983 25 p
(Contract NAS7-918)
(NASA-CR-175324; JPL-400-145-9/82; NAS 1.26:175324) Avail: NTIS HC A02/MF A01 CSCL 14B

Voyager, Infrared Astronomical Satellite, Galileo, Viking, Solar Mesosphere Explorer, Wide-field/Planetary Camera, Venus Mapper, International Solar Polar Mission - Solar Interplanetary Satellite, Extreme Ultraviolet Explores, Starprobe, International Halley Watch, Marine Mark II, Samex, Shuttle Imaging Radar-A, Deep Space Network, Biomedical Technology, Ocean Studies and Robotics are summarized. N.W.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N84-15169# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.
A STUDY TO DETERMINE THE ACCURACY OF 2 COMPUTER PROGRAMS IN PREDICTING HINGE MOMENTS FOR ALL MOVABLE TAIL FINS ON MISSILE BODIES
George A. Sanders, III May 1983 28 p
(AD-A133399; AD-E950432; DRSMI/RD-83-11-TR) Avail: NTIS HC A03/MF A01 CSCL 16/4

The preliminary design of a guided missile with movable control surfaces requires an in-depth study of the aerodynamic loading experienced by these surfaces. GRA

N84-15170# Range Commanders Council, White Sands Missile Range, N. Mex. Data Reduction and Computing Group.
IRIG STANDARD FOR DISTRIBUTING INTERRANGE VECTOR ACQUISITION DATA
Sep. 1983 14 p Supersedes DR/CWG-104-67
(AD-A133617; DR/CG-152-83; DR/CWG-104-67) Avail: NTIS HC A02/MF A01 CSCL 17/9

This document defines a standard procedure for distributing interrange vector acquisition data to remote tracking instruments. The standard procedures set forth herein are recommended, where applicable, for interchange of acquisition data among the National and Service Ranges and other ranges associated with the Range Commanders Council. This standard does not apply to the distribution of raw radar data. GRA

N84-16040*# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
A FEASIBILITY STUDY OF ELECTROMAGNETIC DE-SPIN SYSTEM FOR EARTH ORBITING SATELLITES
Prasad K. Kadaba *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 33 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N84-15171*# Teledyne Brown Engineering, Huntsville, Ala. Payload Missions Integration Div.
PAYLOAD MISSIONS INTEGRATION Progress Report, 19 Sep. - 11 Nov. 1983
28 Nov. 1983 52 p
(Contract NAS8-32712)
(NASA-CR-170949; NAS 1.26:170949; PMIC-MA03-469-29; PO-83-506) Avail: NTIS HC A04/MF A01 CSCL 22B

Spacelab missions 1 to 3, OSTA partial payloads, Astro-1 mission, premission definition, and mission peculiar equipment support structure are discussed. Author

N84-15172*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ALTERNATE CONCEPT FOR EXPANDING MAN'S PRESENCE IN SPACE
W. Ray Hook and Robert S. Osborne Feb. 1983 43 p refs
(NASA-TM-84617; NAS 1.15:84617) Avail: NTIS HC A03/MF A01 CSCL 22A

A logical next step after shuttle is a manned orbital service system (MOSS) consisting of a two-man crew module mated with a propulsion module. The resulting spacecraft would remain in low Earth orbit for months or years at a time conducting civil or military satellite servicing, experimental, or applications missions while being periodically supplied and refueled by Shuttle flights from the ground. The system would accumulate experience invaluable to the design of future large and more expensive spacecraft. Key features of the vehicle are versatility and mobility. With Centaur-type propulsion and a large payload, the MOSS could leave an initial orbit of 370 km (200 nmi) altitude and inclinations up to 56 deg, make a plane change of up to + or - 14 deg, reach altitudes to 5500 km (2970 nmi), and then return the payload to the original orbit altitude and inclination. Obviously, the size of the performance envelope varies with the payload and propulsion-unit selected. The MOSS can reach orbits and perform tasks not possible with Shuttle alone or with the much larger space stations currently being proposed. Author

N84-15173*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
MISSION DEFINITION STUDY FOR A VLBI STATION UTILIZING THE SPACE SHUTTLE Final Report
Bernard F. Burke 12 Oct. 1982 134 p
(Contract NAS5-25543)
(NASA-CR-175126; NAS 1.26:175126) Avail: NTIS HC A07/MF A01 CSCL 22A

The uses of the Space Shuttle transportation system for orbiting VeryLong-Baseline Interferometry (OVLBI) were examined, both with respect to technical feasibility and its scientific possibilities. The study consisted of a critical look at the adaptability of current technology to an orbiting environment, the suitability of current data reduction facilities for the new technique, and a review of the new science that is made possible by using the Space Shuttle as a moving platform for a VLBI terminal in space. The conclusions are positive in all respects: no technological deficiencies exist that would need remedy, the data processing problem can be handled easily by straightforward adaptations of existing systems, and there is a significant new research frontier to be explored, with the Space Shuttle providing the first step. The VLBI technique utilizes the great frequency stability of modern atomic time standards, the power of integrated circuitry to perform real-time signal conditioning, and the ability of magnetic tape recorders to provide essentially error-free data recording, all of which combine to permit the realization of radio interferometry at arbitrarily large baselines. Author

N84-15174*# Axiomatix, Los Angeles, Calif.
ENGINEERING EVALUATIONS AND STUDIES. VOLUME 1: EXHIBIT A Final Report
Unjeng Cheng, James G. Dodds, Jack K. Holmes, Gaylord K. Huth, Richard S. Iwasaki, Robert G. Maronde, Peter W. Nilsen, Andreas Polydoros, Don Roberts, Sergei Udalov et al 31 Oct. 1983 481 p refs 4 Vol.
(Contract NAS9-16067)
(NASA-CR-171724; NAS 1.26:171724; R8310-6-Vol-1) Avail: NTIS HC A21/MF A01 CSCL 22B

Orbiter inertial upper-stage studies, ku-band hardware studies, S-band hardware investigations, shuttle/Centaur communication system engineering investigations are provided. N.W.

N84-15175*# Axiomatix, Los Angeles, Calif.
ENGINEERING EVALUATIONS AND STUDIES. VOLUME 2: EXHIBIT B, PART 1 Final Report
Unjeng Cheng, James G. Dodds, Jack K. Holmes, Gaylord K. Huth, Richard S. Iwasaki, Robert G. Maronde, Peter W. Nilsen, Andreas Polydoros, Don Roberts, Sergei Udalov et al 31 Oct. 1983 322 p refs 4 Vol.
(Contract NAS9-16067)
(NASA-CR-171725; NAS 1.26:171725; R8310-6-Vol-2-Pt-1) Avail: NTIS HC A14/MF A01 CSCL 22B

Ku-band communication system analysis, S-band system investigations, payload communication investigations, shuttle/TDRSS and GSTDN compatibility analysis are discussed. N.W.

N84-15176*# Axiomatix, Los Angeles, Calif.
ENGINEERING EVALUATIONS AND STUDIES. VOLUME 2: EXHIBIT B, PART 2 Final Report
Unjeng Cheng, James G. Dodds, Jack K. Holmes, Gaylord K. Huth, Richard S. Iwasaki, Robert G. Maronde, Peter W. Nilsen, Andreas Polydoros, Don Roberts, Sergei Udalov et al 31 Oct. 1983 343 p refs 4 Vol.
(Contract NAS9-16067)
(NASA-CR-171726; NAS 1.26:171726; R8310-6-Vol-2-Pt-2) Avail: NTIS HC A15/MF A01 CSCL 22B

Preliminary shuttle/Centaur communication system analysis and shuttle global positioning system investigations are discussed. Television digitizer development is also discussed. N.W.

N84-15177*# Axiomatix, Los Angeles, Calif.
ENGINEERING EVALUATIONS AND STUDIES. VOLUME 3: EXHIBIT C Final Report
Unjeng Cheng, James G. Dodds, Jack K. Holmes, Gaylord K. Huth, Richard S. Iwasaki, Robert G. Maronde, Peter W. Nilsen, Andreas Polydoros, Don Roberts, and Sergei Udalov 31 Oct. 1983 650 p refs 4 Vol.
(Contract NAS9-16067)
(NASA-CR-171727; NAS 1.26:171727; R8310-6-Vol-3) Avail: NTIS HC A99/MF A01 CSCL 22B

High rate multiplexes asymmetry and jitter, data-dependent amplitude variations, and transition density are discussed. N.W.

N84-15178*# Arkansas Univ., Fayetteville. Dept. of Mathematical Sciences.
STATISTICAL MODELING OF SPACE SHUTTLE ENVIRONMENTAL DATA Final Report, 24 Jul. 1981 - 23 Oct. 1983
J. D. Tubbs and D. W. Brewer 23 Oct. 1983 149 p refs
(Contract NAS8-34502)
(NASA-CR-170940; NAS 1.26:170940) Avail: NTIS HC A07/MF A01 CSCL 22B

The density function and corresponding moments for the ratio of correlated gamma distributed variates were derived. A class of bivariate gamma distributions is considered and some additional distributional results using this class of functions are found. Similar results using a different class of bivariate gamma distributions are presented. E.A.K.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N84-15883 Selenia S.p.A., Rome (Italy). Research Dept.
ADVANCED TECHNIQUES OF LASER TELEMETRY
Silvano Donati (Pavia Univ.) and Aldo Gilardini *In its* Riv. Tec. Selenia, Vol. 8, No. 2, 1982 1982 p 1-13 refs (For primary document see N84-15882 06-70)
Avail: Issuing Activity

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N84-15179*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CAPTURE-EJECTOR SATELLITES
Ian O. MacConochie, Charles H. Eldred, and James A. Martin Oct. 1983 23 p refs Previously announced in IAA as A82-43265
(NASA-TM-85686; NAS 1.26:85686) Avail: NTIS HC A02/MF A01 CSCL 22B

A satellite in the form of a large rotating rim which can be used to boost spacecraft from low-Earth orbit to higher orbits is described. The rim rotates in the plane of its orbit such that the lower portion of the rim is traveling at suborbital velocity, while the upper portion is travelling at greater than orbital velocity. Ascending spacecraft or payloads arrive at the lowest portion of the rim at suborbital velocities, where the payloads are released on a trajectory for higher orbits; descending payloads employ the reverse procedure. Electric thrusters placed on the rim maintain rim rotational speed and altitude. From the standpoint of currently known materials, the capture-ejector concept may be useful for relatively small velocity increments. Author

N84-15180*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MECHANICAL FASTENER Patent Application
Albert B. Stacy, Jr., inventor (to NASA) Filed 7 Oct. 1983 11 p (NASA-Case-LAR-12738-2; US-Patent-Appl-SN-539230) Avail: NTIS HC A02/MF A01 CSCL 22B

A device for fastening a temporary replacement heat shield tile to the strain isolation pad of a space vehicle is disclosed. An internally threaded, flanged cylinder is rotatably connected to a threaded brass plug through a flanged aluminum sleeve to form the device. The device is adhesively attached to the replacement tile before using. In using the device, the tile containing the device is placed against the strain isolation pad of the space vehicle such that the flanged portion of the flanged cylinder rests against the strain isolation pad. This flanged portion, which consists of a plurality of 'L' shaped blades, is then rotated into the strain isolation pad. The brass plus is then rotated with respect to the flanged stainless steel cylinder to draw the tile snuggly against the strain isolation pad and thus complete the fastening process. NASA

N84-15181# TRW Space Technology Labs., Redondo Beach, Calif.
ACOSS FOURTEEN (ACTIVE CONTROL OF SPACE STRUCTURES) Final Technical Report, 23 Jun. 1981 - 30 Oct. 1982
Robert J. Benhabib, Henry K. Flashner, and Frank C. Tung Mar. 1983 260 p
(Contracts F30602-81-C-0194; DARPA Order 3654; AF Proj. C654)
(AD-A133411; RADC-TR-83-51) Avail: NTIS HC A12/MF A01 CSCL 22/2

ACOSS Fourteen is one of a series of studies for the development of a unified structural dynamics and control technology base to support future development of large space systems. The major emphasis in these studies in the past has been on generic control law development for active vibration suppression. The emphasis is now shifting towards hardware development and experimental verification of the technology. ACOSS Fourteen studies the definition, design and plan for an on-orbit, Shuttle-based Proof of Concept demonstration and stability enduring designs which extend previous designs and treat noncolocated actuator-sensor control systems, while remaining insensitive to modal truncation and inaccurate structural models. Author (GRA)

N84-15182# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
STUDY ON DAMPING REPRESENTATION RELATED TO SPACECRAFT STRUCTURAL DESIGN Final Report
E. Hilbrandt Paris ESA Feb. 1983 210 p refs
(Contract ESTEC-4435/80/NL-AK(SC))
(EMSB-18/83; ESA-CR(P)-1770) Avail: NTIS HC A10/MF A01

Damping representation models for spacecraft dynamic response analysis, and system damping prediction methods were analyzed. Results show that the only suitable damping model is the viscous damping model. For response analysis with adapted modal viscous damping values the response of a structure may be predicted with adequate accuracy if a derived coupling criteria is not violated. Otherwise the response should be predicted with a corrective method or the exact analysis with complex eigenmodes. Damping prediction methods for system damping from substructure damping are far more sensitive to the damping characteristics of the substructures than response analysis methods. Because of damping coupling effects nonproportional damping characteristics have to be incorporated in these system damping prediction methods. Damping estimation methods are not adequate for damping prediction; system identification must be applied. Differences between random and harmonic test methods are treated and system identification with random response data is discussed. Author (ESA)

N84-16052*# Alabama Univ., Huntsville.
ORBITAL MANEUVERING VEHICLE SIMULATION SYSTEM ON-BOARD PROCESSING LOGIC
William Teoh *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 67 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 22A

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N84-15183*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROPULSION APPARATUS AND METHOD USING BOIL-OFF GAS FROM A CRYOGENIC LIQUID Patent Application
Dale H. Blount, inventor (to NASA) Filed 14 Dec. 1983 12 p
(NASA-Case-MFS-25946-1; US-Patent-Appl-SN-561432) Avail: NTIS HC A02/MF A01 CSCL 21H

The attitude and drag of a space vehicle are controlled by using the helium dewar which contains liquid helium for cooling an experiment package. The helium is heated or vented to keep the temperature between 1.5 and 1.7 degrees K to maintain helium boil-off gas adequate as a propellant without adversely affecting the experiment package which is contained in the helium dewar for protection from solar heating. The apparatus includes an auxiliary heater and a sensor for controlling the temperature of the helium. The boil-off gas propellant is delivered to thruster modules to control vehicle attitude and compensate for drag.
NASA

N84-15184# Air Force Systems Command, Wright-Patterson AFB, Ohio.
JOURNAL OF ENGINEERING THERMOPHYSICS (SELECTED ARTICLES)
13 Sep. 1983 67 p Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 3, no. 4, Nov. 1982 p 323-336; 346-356; 361-364; 403-409
(AD-A133167; FTD-ID(RS)T-0285-83) Avail: NTIS HC A04/MF A01 CSCL 21/8

Extrapolation formulas of rocket engine performance parameters are established utilizing one isentropic reference line and two partial derivatives for fixed enthalpy. These formulas can be used for the extrapolation calculations of some parameters such as specific thrust, nozzle area ratio, and the thermodynamic parameters at the combustion chamber and nozzle exit when changes occur in the initial enthalpy of the propellant. The formulas are simply convenient, and have relatively high accuracy. R.J.F.

N84-15185# Naval Ordnance Station, Indian Head, Md. Air Weapons Systems Branch.
VERNIER ROCKET MOTOR MK 84 MOD 0 QUALITY EVALUATION
William G. Mitchell, Jr. 14 Sep. 1983 22 p
(AD-A133301; REPT-3012C4:WGM) Avail: NTIS HC A02/MF A01 CSCL 21/8

This program was conducted to determine the present performance capability and safety of the Vernier Rocket Motor Mk 84 Mod 0 and to determine the feasibility of extending the service life of the Vernier Rocket Motor Mk 84 Mod 0. A sample of 12 motors, ranging in age from 89 to 120 months was evaluated. Tests included visual and radiographic inspections, static-firings at either -40 F to 160 F and a post-firing inspection. All motors were found to be in good condition both before and after static-firing. No propellant anomalies were detected and all units were assembled correctly. Three motors at 160 F exceeded the upper specification limit of 323 msecs for action time. These same three motors also exceeded the upper specification limit of 305 msecs for burn time at 160 F. All other parameters were within the specification limits. Based on the results of this evaluation, it was concluded that the Vernier Rocket Motor Mk 84 Mod 0 will perform acceptably for continued safe operation of the ESCAPAC ejection seat. GRA

N84-15186# Fulmer Research Inst. Ltd., Stoke Poges (England).
FIELD EMISSION ELECTRIC PROPULSION: ADDITIONAL PROPELLANTS: FURTHER TESTS ON INDIUM AND ALLOYS Final Report
P. D. Wilson and D. Stewart Paris ESA Feb. 1983 60 p refs (Contract ESTEC-4793/81/NL-AK-(SC))
(R664; ESA-CR(P)-1767) Avail: NTIS HC A04/MF A01

Ion thruster experiments on indium and alloys to find a method of making the propellant wet the surfaces of a slit emission thruster and enhance the flow of propellant to the apex of the emitter where emission occurs are described. A copper interface layer is satisfactory for improving the wetting of indium propellant. In tests using a gas propellant in a linear slit emitter, stable emission is obtained from sources with slit widths of 20 microns or greater. High current densities (14mA/cm) and low beam divergence are obtained. Mass efficiency, however, is always $< 0.05\%$. The study confirms that the best propellant is cesium. Tests to determine if indium, or one of the alternatives, can operate satisfactory using enchanced wetting procedures are proposed.
Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N84-15187# Oak Ridge National Lab., Tenn.
METALS AND CERAMICS RESEARCH: PROCESSING, PROPERTIES, AND APPLICATIONS []
Irene Brogden, ed. Apr. 1983 105 p
(Contract W-7405-eng-26)
(ORNL-5943) Avail: NTIS HC A06/MF A01

Materials compatibility, mechanical properties, nondestructive testing, pressure vessel technology, welding and brazing, alloying, ceramics, fuel cycle, metals processing, structural ceramics, physical properties, radiation effects, and microstructural analysis, surface and solid state reactions, X-ray research and application, and metalography, are discussed. Author

N84-15188# Council for Scientific and Industrial Research, Pretoria (South Africa). National Chemical Research Lab.
[ACTIVITIES OF THE NATIONAL CHEMICAL RESEARCH LABORATORY] Annual Report
1982 130 p refs
(CSIR-SR-CHEM-261; ISBN-0-7988-2519-7) Avail: NTIS HC A07/MF A01

Research activities in organic, inorganic, and physical chemistry are reported. Corrosion research, procedures in chemical analysis, biological chemistry, and molecular biochemistry are also discussed. For individual titles, see N84-15189 through N84-15192.

N84-15189# Council for Scientific and Industrial Research, Pretoria (South Africa).
ANALYTICAL CHEMISTRY **c25**
In its Activities of the National Chemical Research Lab. 1982 p 7-17 refs (For primary document see N84-15188 06-23)
Avail: NTIS HC A07/MF A01

Progress in the development of specific and quantitative separation procedures for minor and trace elements occurring in rocks, minerals and other complex materials is reported. The final aim is to develop more reliable and accurate methods for the determination of these elements in such materials, and advancing the borders of reliable and accurate determinations to lower and lower concentrations. A useful feature of the work is that many of the developed separation procedures can, with slight simplification and adaption, be used for the separation of carrier-free radioisotopes from irradiated cyclotron targets. M.G.

N84-15190# Council for Scientific and Industrial Research, Pretoria (South Africa).
BIOLOGICAL CHEMISTRY **c51**

In its Activities of the National Chemical Research Lab. 1982 p 19-28 (For primary document see N84-15188 06-23)
Avail: NTIS HC A07/MF A01

Research aimed at increasing basic knowledge of the factors influencing digestion and metabolism in ruminants is described. Specific investigations include: the number and types of fiber-digesting bacteria in the rumen of sheep fed increasing amounts of maize grain; influence of starch and sugars on the digestion of cellulose by rumen bacteria; the effects of pH, Na(+), and osmolality on the growth of rumen bacteria; and the breakdown and synthesis of protein in the rumen. M.G.

N84-15191# Council for Scientific and Industrial Research, Pretoria (South Africa).
CORROSION RESEARCH **c26**
In its Activities of the National Chemical Research Lab. 1982 p 29-50 (For primary document see N84-15188 06-23)
Avail: NTIS HC A07/MF A01

Projects investigating corrosion reactions of metallic materials in electrochemical and aggressive environments are described. Specific topics include: stress corrosion cracking of stainless steels, hydrogen evolution by metals in various environments, oxygen reduction reactions during metal corrosion, cyclic voltammetry analysis, and the corrosion of motor car cooling systems by inhibited anti-freeze additives. M.G.

N84-15192# Council for Scientific and Industrial Research, Pretoria (South Africa).
INORGANIC CHEMISTRY **c25**
In its Activities of the National Chemical Research Lab. 1982 p 51-61 refs (For primary document see N84-15188 06-23)
Avail: NTIS HC A07/MF A01

Activities directed at obtaining a fundamental insight into the chemical properties necessary for compounds of the platinum metals to perform as active catalysts are described. Emphasis was given to: (1) investigations into new routes to compounds of potential catalytic activity; (2) elucidating mechanistic pathways in solution of catalytic reactions in efforts to optimize conditions controlling catalytic activity; and (3) structural determinations of series of complexes in an effort to correlate molecular structure with chemical reactivity. M.G.

N84-15193# Rochester Univ., N. Y. Dept. of Chemistry.
APPLICATION OF THE DENSITY MATRIX MULTIPOLE EXPANSION TO STARK QUANTUM BEATS FROM BEAM-FOIL-EXCITED HYDROGEN ATOMS
Franco Battaglia and Thomas F. George Oct. 1983 19 p
(Contract N00014-80-C-0472)
(AD-A133603; U-ROCHESTER/DC/83/TR-40) Avail: NTIS HC A02/MF A01 CSCL 07/4

The density matrix multipolar expansion theory, as applied to radiation from polarized atoms, is outlined. A calculation is performed for Stark quantum beats from beam-foil-excited hydrogen atoms, and comparison is good with experimental results.
Author (GRA)

24 COMPOSITE MATERIALS

Includes laminates.

N84-15194 George Washington Univ., Washington, D.C.
STATIC AND DYNAMIC STIFFNESS REDUCTION OF GRAPHITE/EPOXY COMPOSITE LAMINATES UNDER FATIGUE LOADING Ph.D. Thesis
Horace Algernon Whitworth 1983 197 p refs
Avail: Univ. Microfilms Order No. DA8324493

An investigation was conducted into the effect of fatigue loading on the stiffness and strength degradation of composite laminates. A set of fatigue tests was conducted on two orientations of graphite/epoxy laminates: (0, 90, + or - 45) subs and (+ or - 35) sub Zs. Both static and dynamic stiffness were continually monitored during the fatigue tests, for a wide range of stress levels, and the results presented for each stress level tested. Residual strength tests were also performed on some laminates during this test program. A model was proposed which related the residual stiffness degradation to the fractional life expanded at a given maximum stress level. This model is restricted to specimens subjected to constant amplitude fatigue loading. This model is based on the assumption that the residual stiffness decreases monotonically as the number of load cycles is increased. It involves three parameters which are determined from base-line data using the statistical method of steepest descent.
Dissert. Abstr.

N84-15195 Delaware Univ., Newark.
STRENGTH THEORIES OF CONTINUOUS AND DISCONTINUOUS FIBER COMPOSITES Ph.D. Thesis
Fuminori Hikami 1983 222 p
Avail: Univ. Microfilms Order No. DA8324101

This dissertation studies the strength of unidirectionally reinforced fiber composites affected by the discontinuity of fibers. The fiber stress field around a transverse crack is analyzed using the two dimensional shear-lag method. Closed form expressions of fiber stress concentration factors are obtained for the elastic crack problems. These results include the rigorous proofs of Hedgepeth's inspection on the maximum stress concentration factor and Fichter's inspection on the maximum shear stress concentration factor as special cases. Inelastic expressions of fiber stress concentrations are also obtained using series expansion method. By making use of these closed form expressions of stress concentration factors, the strength of discontinuous fiber composites and the strength of continuous fiber composites with notch are discussed. Some of the results are compared with existing theories and experimental results. Dissert. Abstr.

N84-15196*# Clemson Univ., S.C. Dept. of Mechanical Engineering.
FRACTURE BEHAVIOR OF UNIDIRECTIONAL BORON/ALUMINUM COMPOSITE LAMINATES Final Report
James G. Goree and Walter F. Jones Dec. 1983 108 p refs
(Grant NsG-1297)
(NASA-CR-3753; NAS 1.26:3753) Avail: NTIS HC A06/MF A01 CSCL 11D

An experiment was conducted to verify the results of mathematical models which predict the stresses and displacements of fibers and the amount of damage growth in a center-notched lamina as a function of the applied remote stress and the matrix and fiber material properties. A brittle lacquer coating was used to detect the yielding in the matrix while X-ray techniques were used to determine the number of broken fibers in the laminate. The notched strengths and the amounts of damage found in the specimens agree well with those predicted by the mathematical model. It is shown that the amount of damage and the crack opening displacement does not depend strongly on the number of plies in the laminate for a given notch width. By heat-treating certain laminates to increase the yield stress of the alumina matrix, the effect of different matrix properties on the fracture behavior was investigated. The stronger matrix is shown to weaken the notched laminate by decreasing the amount of matrix damage, thereby making the laminate more notch sensitive. Author

N84-15197# Los Alamos Scientific Lab., N. Mex.
PRODUCTION AND CHARACTERIZATION OF BETA-SILICON CARBIDE AND ALPHA-SILICON NITRIDE WHISKERS FOR CERAMIC MATRIX COMPOSITES
J. V. Milewski, F. D. Gac, and J. J. Petrovic Feb. 1983 10 p refs
(Contract W-7405-eng-36)
(LA-9650-MS) Avail: NTIS HC A02/MF A01

The sequence of LVS (vapor feed gases, liquid catalyst, and solid crystalline whisker growth) is described and as well as the structure of Si3N4 and SiC whiskers grown by this process. Mechanical tests of beta-SiC whiskers, measuring 5 to 6 micrometers in diameter and approximately 5 micrometers in length, show an average tensile strength of 134 1354 kpsi, an elastic modulus

of 99,893 kpsi, and elastic strain to fracture of 1.23%. The major impurity revealed by spectrochemical analysis is aluminum with Na, Mg, Ca, and Fe present to a lesser degree. A.R.H.

N84-15196# Cranfield Inst. of Tech., Bedfordshire (England). College of Aeronautics.

STIFFNESS CHANGES IN UNIDIRECTIONAL COMPOSITES CAUSED BY CRACK SYSTEMS

N. Laws, G. J. Dvorak, and M. Hejazi Jun. 1983 35 p refs (CA-8311; ISBN-0902937-90-1) Avail: NTIS HC A03/MF A01

The development of constitutive equations for fibrous composites which contain a family of longitudinal slit cracks is considered. It is assumed that the cracks and fibers have diameters of similar size and that there is mutual interaction. The special case of small diameter fibers and large cracks is also investigated. The overall elastic moduli and compliances of each cracked fibrous composite are obtained from a variant of the self-consistent method. A.R.H.

N84-15199*# National Aeronautics and Space Administration. Langley Research Center, Hampton. Va.

ANALYSIS OF LOCAL DELAMINATIONS AND THEIR INFLUENCE ON COMPOSITE LAMINATE BEHAVIOR

T. Kevin OBrien Jan. 1984 30 p refs Presented at the ASTM Symp. on Delamination and Debonding of Mater., Pittsburgh, 8-10 Nov. 1983

(DA Proj. 1L1-61102-AH-45)

(NASA-TM-85728; USAAVSCOM-TR-83-B-6; NAS 1.15:85728) Avail: NTIS HC A03/MF A01 CSCL 11D

An equation was derived for the strain energy release rate, G, associated with local delamination growth from a matrix ply crack. The critical GC for edge delamination onset in [25/902]s graphite epoxy laminates was measured and used in this equation to predict local delamination onset strains in [25/90n]s, n = 4, 6, 8 laminates. A simple technique for predicting strain concentrations in the primary load bearing plies near local delaminations was developed. These strain concentrations were responsible for reduced laminate nominal failure strains in laminates containing local delaminations. The influence of edge delamination and matrix crack tip delamination on laminate stiffness and strength was compared. Author

N84-15200*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

USER'S MANUAL FOR GAMNAS: GEOMETRIC AND MATERIAL NONLINEAR ANALYSIS OF STRUCTURES

John D. Whitcomb and B. Dattaguru Jan. 1984 40 p refs (NASA-TM-85734; NAS 1.15:85734) Avail: NTIS HC A03/MF A01 CSCL 11D

GAMNAS (Geometric and Material Nonlinear Analysis of Structures) is a two dimensional finite-element stress analysis program. Options include linear, geometric nonlinear, material nonlinear, and combined geometric and material nonlinear analysis. The theory, organization, and use of GAMNAS are described. Required input data and results for several sample problems are included. Author

N84-15201*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ANALYSIS OF INTERLAMINAR STRESSES IN THICK COMPOSITE LAMINATES WITH AND WITHOUT EDGE DELAMINATION

John D. Whitcomb and I. S. Raju (Vigyan Research Associates, Inc.) Jan. 1984 49 p refs Presented at the ASTM Symp. on Delamination and Debonding of Mater., Pittsburgh, 8-10 Nov. 1983

(NASA-TM-85738; NAS 1.15:85738) Avail: NTIS HC A03/MF A01 CSCL 11D

The effect of laminate thickness on the interlaminar stresses in rectangular quasi-isotropic laminates under uniform axial strain was studied. Laminates from 8-ply to infinitely thick were analyzed. Thick laminates were synthesized by stacking (45/0/-45/90) ply groups, rather than grouping like plies. Laminates with and without delaminations were studied. In laminates without delaminations, the free-edge interlaminar normal stress distribution in the outer ply groups was insensitive to total laminate thickness. The interlaminar normal stress distribution for the interior ply groups was nearly the same as for an infinitely thick laminate. In contrast, the free-edge inter-laminar shear stress distribution was nearly the same for inner and outer ply groups and was insensitive to laminate thickness. In laminates with delaminations those delaminations near the top and bottom surfaces of a thick laminate have much larger total strain-energy-release rates (G sub t) and mode I-to-total (G sub t/G sub t) ratios than delaminations deep in the interior. Therefore, delaminations can be expected to grow more easily near the surfaces of a laminate than in the interior. B.W.

N84-15202*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PHOSPHOROUS-CONTAINING IMIDE RESINS Patent Application

Indra K. Varma (NAS-NRC, Washington, D.C), George M. Fohlen, and John A. Parker, inventors (to NASA) Filed 11 Jul. 1983 16 p

(NASA-Case-ARC-11368-3; US-Patent-Appl-SN-512795) Avail: NTIS HC A02/MF A01 CSCL 11D

Flame-resistant reinforced bodies are disclosed which are composed of reinforcing fibers, filaments or fabrics in a cured body of bis- and tris-imide resins. These resins are derived from tris(m-aminophenyl) phosphine oxides by reaction with maleic anhydride or its derivatives, or of addition polymers of such imides, including a variant in which a mono-imide is condensed with a dianhydride and the product is treated with a further quantity of maleic anhydride. NASA

N84-15203*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ARC SPRAY FABRICATION OF METAL MATRIX COMPOSITE MONOTAPE Patent Application

L. J. Westfall, inventor (to NASA) Filed 9 Dec. 1983 12 p

(NASA-Case-LEW-13828-1; US-Patent-Appl-SN-560035) Avail: NTIS HC A02/MF A01 CSCL 11D

Arc metal spraying is used to spray liquid metal onto an array of high strength fibers that have been previously wound onto a large drum contained inside a controlled atmosphere chamber. This chamber is first evacuated to remove gaseous contaminants and then backfilled with a neutral gas up to atmospheric pressure. This process is used to produce a large size metal matrix composite monotape. NASA

N84-15204# Naval Ship Research and Development Center, Bethesda, Md. Structures Dept.

RUBBER-MODIFIED EPOXY AND GLASS LAMINATES FOR APPLICATION TO NAVAL SHIP STRUCTURES Final Report

William P. Couch, Aleksander B. Macander, and Roger M. Crane Sep. 1983 43 p Presented at the 28th Natl. Sampe Symp., Anaheim, Calif., 12-14 Apr. 1983

(SF6154101)

(AD-A133305; DTNSRDC-83/048) Avail: NTIS HC A03/MF A01 CSCL 13/10

Because the decks and other structural elements of naval combatants are exposed to extreme handling and wear loads during construction, and operational and overhaul periods, a rubber-modified epoxy resin is being evaluated for application to naval ship structures. Preliminary results indicate that the rubber-modified resin performs substantially better in impact-resistance tests than do laminates of standard brittle glass-reinforced plastic (GRP). Drop-ball impact tests are performed on 6.5-in. diameter, 0.25-in. thick disks. Currently, very little is known about the mechanics of this phenomena, its long-term behavior in a marine environment, and its characteristics when incorporated into a complex structure. A series of tests have been conducted on specimens, joints, panels, and structural components in an attempt to gain more information. Two generic carboxy terminated butadiene acrylonitrile (CTBN)-modified epoxy/glass cloth material systems have been characterized, exposed to fatigue and long-term immersion loading,

and evaluated when incorporated into several different structural configurations. The results of all these tests indicate that this material can withstand the harsh environmental and inservice loading conditions experienced by naval combatants.
Author (GRA)

N84-15205# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.
THE EFFECT OF ENVIRONMENT ON THE MECHANICAL BEHAVIOR OF AS/3501-6 GRAPHITE/EPOXY MATERIAL Final Report, Aug. 1981 - Nov. 1982 on Phase 4
T. Ho and R. A. Schapery Feb. 1983 83 p
(Contract N00019-81-C-0179)
(AD-A133331; ATC-R-92000/3CR-9) Avail: NTIS HC A05/MF A01 CSCL 11/4

The effect of temperature and moisture on the fatigue properties of AS/3501-6 composite was investigated. Micromechanics was used to relate the composite's compliance to the matrices' compliance. The stress state of the laminate was studied by using Tsai-Wu quadratic failure criterion through uniaxial specimen testings. Intralaminar cracks and delaminations were studied by testing (+ or - 45/902)s layup specimens. A laminate analysis method was used to evaluate the energy release rate of the (+ or - 45/902)s specimens. Results indicate that predicted critical strains are above those for which specimens begin to exhibit noticeable softening due to damage. To improve fatigue failure prediction behavior intraply microcracking must be accounted for in the theoretical model. GRA

N84-15206# Virginia Polytechnic Inst. and State Univ., Blacksburg. Materials Response Group.
FATIGUE DAMAGE-STRENGTH RELATIONSHIPS IN COMPOSITE LAMINATES. VOLUME 1 Final Report, 1 Jun. 1981 - 31 May 1983
Kenneth L. Reifsnider, W. W. Stinchcomb, E. G. Henneke, and J. C. Duke Wright-Patterson AFB, Ohio AFWAL Sep. 1983 52 p 2 Vol.
(Contract F33615-81-K-3225; AF Proj. 2307)
(AD-A133485; AFWAL-TR-83-3084-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 11/4

This report is Vol. I of a 2-part final report on the activities which were conducted under Contract No. F33615-81-3225. The general objective of this program was to investigate the precise nature of the damage events caused by cyclic (fatigue) loading of composite laminates that are directly related to fracture of those laminates, to develop a conceptual understanding of how those damage events reduce the residual strength of the laminates, and to determine how the collective damage condition following long-term cyclic loading precipitates the final fracture event. The program was conducted in four phases: (1) the development of fatigue damage during long-term cyclic loading was investigated in such a way that the damage events which occur quite late in the fatigue life of the material, just prior to fracture, were identified and characterized; (2) the special contribution and nature of fiber fracture was investigated; (3) the nature of the collective damage condition which precipitates the fracture event under long-term fatigue loading was investigated; (4) a philosophy of fracture in composite laminates following severe damage development due to cyclic loading was developed. A wide variety of destructive and nondestructive experimental evaluation schemes were used in the program, and several analytical efforts were conducted to support the experimental activities. GRA

N84-15207# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
COMPOSITE LAMINATE WEIGHT OPTIMIZATION ON THE HX-20 Final Technical Report
Gerald V. Flanagan Aug. 1983 32 p
(AF Proj. 2307)
(AD-A133490; AFWAL-TR-83-4061) Avail: NTIS HC A03/MF A01 CSCL 11/4

An automated method is presented for sizing composite laminate to get minimum total thickness. The method can handle multiple, independent inplane loads, Sizing is based on strength requirements. A listing is presented in BASIC for an Epson HX-20 microcomputer. Author (GRA)

N84-15208# Research Inst. of National Defence, Stockholm (Sweden). Dept. 2.
RESIN DEVELOPMENT IN ADVANCED COMPOSITES
Anders Wirsen Sep. 1983 60 p refs
(FOA-C-20509-F9; ISSN-0347-3694) Avail: NTIS HC A04/MF A01

Modifications of and alternatives to epoxy systems used in advanced composites are described. Thermosetting systems and thermoplastic matrix materials are discussed. High temperature resistant polymers for composites are reviewed. The chemical-physical background to processing and end use properties, and mechanical properties are outlined. Author (ESA)

N84-15209# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain). Dept. de Estructuras y Materiales Estructurales.
STATUS OF FIBER REINFORCED MATERIALS [ESTADO ACTUAL DE LA PROBLEMATICA DE LOS MATERIALES ENFIBRADOS]
A. MadronerodelaCal 1983 36 p refs In SPANISH
Avail: NTIS HC A03/MF A01

Technological knowledge of fiber reinforced materials is reviewed. In the case of unidirectional reinforcement, both the micromechanical concepts and the failure mechanism are clear. In the case of multidirectional reinforcement, elastic theory is deemed satisfactory, while the failure mechanisms theory appears incomplete. Glass fibers, metallic fibers, carbon fibers, ceramic fibers and organic fibers are discussed. Author (ESA)

N84-15210 Rensselaer Polytechnic Inst., Troy, N. Y.
BIAXIAL FATIGUE OF GRAPHITE/EPOXY + OR - 45 SUB S TUBES Ph.D. Thesis
Tyan-Min Niu 1983 186 p
Avail: Univ. Microfilms Order No. DA8321209

Thin-walled unnotched graphite/epoxy tubes consisting of four layers of + or - 45 sub s laminates were subjected to axial, torsional and combined in-phase and out-of-phase axial and torsional loading through the use of a computer controlled MTS servohydraulic tension-torsion system. Axial, diametral and shear strains measurements were taken on the gage length of the tubes. Ultimate tensile and compressive strengths were found to be equal while the ultimate shear strengths exhibited a strong dependence on the direction of twist. Local buckling was found to be responsible for low ultimate shear strength. Creep and relaxation behaviors were studied during multistep tests. It was observed that under load control the hysteresis loop size increased with a decrease in loading rate. All the fatigue tests were performed under completely reversed load-controlled conditions up to 1 million cycles using a sine wave at frequencies ranging from 0.01 to 10 Hz.
Dissert. Abstr.

N84-15211 Rensselaer Polytechnic Inst., Troy, N. Y.
FINITE ELEMENT ANALYSIS OF MOISTURE AND EXTERNAL LOADING EFFECTS IN COMPOSITES Ph.D. Thesis
Frida Evelina Romauli Lumban-Tobing 1983 266 p
Avail: Univ. Microfilms Order No. DA8321205

Moisture adversely affects the properties of graphite-epoxy composites. A major contribution to this degradation is the internal stresses and strains caused by inhomogeneous swelling. The inhomogeneous swelling arises because the epoxy matrix absorbs moisture and swells while the carbon fibers do not swell. To determine the internal strain, stress and moisture fraction fields within a swollen composite, numerical analysis procedure for the micromechanical analysis of this problem was developed. The procedure employs a nonlinear constitutive relationship in a finite element formulation. The nonlinear constitutive equation relates the stress, strain and volume fraction of liquid in the mixture for plane-strain problems. This constitutive equation was developed using Flory-Huggins expression with a variable polymer-solvent

interaction parameter in the free energy of mixing term. It also was developed using a Gaussian work function with a moisture softening modulus. Dissert. Abstr.

N84-15312# Minnesota Univ., Minneapolis. Lab. for Physical Electronics.
SPUTTERING OF MULTICOMPONENT MATERIALS
G. K. Wehner *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 117-129 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-16031*# Georgia Inst. of Tech., Atlanta. School of Mathematics.
MECHANICAL PROPERTY CHARACTERIZATION OF F-100/934 GRAPHITE-EPOXY COMPOSITE MATERIAL
Raymond G. Clinton, Jr. *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 28 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N84-15212# British Gas Corp., London (England).
COMPLETE SAMPLE ANALYSIS BY GAS CHROMATOGRAPHY
H. Schutz 8 Nov. 1983 9 p refs Transl. into ENGLISH from Erdoel-Erdgas-Petrochem. Vereinigt mit Brennstoff-Chem. (West Germany), v. 36, no. 6, Jun. 1983 p 279-280
(BLL-T6213/BG/LRS/LRST671/83) Avail: British Library Lending Div., Boston Spa, Engl.

The advantages of capillary gas chromatography are presented. The instantaneous sampling, ability to use liquid and gas portions without splitting sample, infinite shelf life of the samples in the ampules, and reduction of error are discussed. B.G.

N84-15213# Electricity Council, London (England).
METHODS IN COMPETITION WITH ELECTROPLATING
H. Simon 15 Aug. 1983 24 p refs Transl. into ENGLISH from Galvanotech. (West Germany), v. 70, no. 4, 1979 p 298-304
(BLL-OA-Trans-3037-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

Stemming from the demand for functional surfaces, which has arisen over the course of time because of the advances in electrical engineering, physics, chemistry and metallurgy, numerous new coating techniques were developed and marketed. These techniques and results achieved with them are described. By means of a comparison of the intended applications and application limits of the techniques, an attempt will then be made to show whether these techniques are in competition with electroplating or supplement the latter. Author

N84-15214 Stanford Univ., Calif.
HIGH RESOLUTION ULTRAVIOLET LASER SPECTROSCOPY OF MERCURY AND HELIUM Ph.D. Thesis
Louis Aub Bloomfield 1983 206 p
Avail: Univ. Microfilms Order No. DA8320685

The fine and hyperfine structures of several lines in mercury and helium have been investigated by Doppler-free spectroscopy with the aid of tunable continuous-wave ultraviolet radiation. This radiation has been produced by second harmonic generation and sum-frequency mixing in a nonlinear crystal, with primary beams produced by a dye laser and a gas ion laser. The ultraviolet light is synthesized with the help of the circulating visible light in a four mirror ring cavity, with or without a gain medium. Over 50 mW of narrowband coherent radiation has been obtained at 295 nm, 4 nW at 265 nm, and 1 mW at 243 nm. These powers represent a large improvement over single pass synthesis techniques. Radiation at 243 nm has an important application to measurements of the 1s - 2s transition in atomic hydrogen. Two transitions in atomic mercury, at 297 nm and 246 nm, were studied by saturated absorption spectroscopy of an RF gas discharge. The isotope and hyperfine structures of these transitions were measured with an accuracy of - 15 MHz. Dissert. Abstr.

N84-15215 Georgia Inst. of Tech., Atlanta.
COMBUSTION AT THE INTERFACE OF AN OXIDIZER-FUEL SLAB SYSTEM Ph.D. Thesis
Ramaprasad Ramakrishniah Panyam 1983 172 p
Avail: Univ. Microfilms Order No. DA8322561

This work describes a combined analytical and experimental investigation of the propagation of a burning front along the contact surface of a solid oxidizer - solid fuel slab system. The experimental part consists of determination of the interface burn rate and the burning surface profile of an Ammonium Perchlorate - Polymethylmethacrylate slab system. The analytical part models the energy transport in the gas and solid phases and momentum transfer in the gas phase. It is based on two dimensional conservation equations. Formulation of the analysis is designed to use the experimental results as boundary conditions for the analysis. The gas phase heat transfer analysis includes an arbitrary, spatially distributed heat source. This distribution is varied in order to achieve reconcillation of the imposed boundary conditions. The work evaluates the qualitative and quantitative effects of physico-chemical constants that characterize the system. The importance of convective heat transfer has been pointed out. Dissert. Abstr.

N84-15216 Stanford Univ., Calif.
THE CARS SPECTROSCOPY IN A SUPERSONIC JET Ph.D. Thesis
Eric Keith Gustafson 1983 198 p
Avail: Univ. Microfilms Order No. DA8320713

CARS is a promising new technique for very high resolution Raman spectroscopy. Toward adapting the technique to this end, a program of research at Stanford to develop CARS in an underexpanded axisymmetric supersonic jet was undertaken. The cold isentropic expansion zone of the jet makes available a very broad range of pressures and temperatures. Simply probing various positions in the flow field of the jet makes these different pressures and temperature accessible. In addition, the spectral simplication and the narrowing that take place at low temperatures resolve rotational components, making line assignments possible. At a resolution of 205-MHz the dominant broadening mechanism is transit time broadening. A lineshape theory that includes the transit time broadening effect and produces excellent agreement with the experimental results was developed. Dissert. Abstr.

N84-15217# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
PROCEDURE FOR PRODUCING HIGHER HYDROCARBONS
Ludwig Babernics 1983 12 p Transl. into ENGLISH of German Patent no. P-3116409.9 (24 Apr. 1981)
(NRC/CNR-TT-2073; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The procedure is discussed for producing higher hydrocarbons, in particular for the production of ethane from methane. In this process, the temperature was adequate for dissociative chemisorption on a platinum catalyst surface. A catalytic cooling (C-C) is brought about at a temperature at which C-C recombination occurs. An intermediate surface product arising in the course of that step, which consists largely of chemisorbed C2 hydrocarbons, is desorbed in a current of H2 at constant temperature, in order to produce a final product consisting largely of ethane. R.J.F.

N84-15218# Cranfield Inst. of Tech., Bedfordshire (England). College of Aeronautics.
A REVIEW OF THEORIES CURRENTLY BEING USED TO MODEL STEADY PLANE FLAMES ON FLAME-HOLDERS

A. C. McIntosh and J. F. Clarke Jun. 1983 59 p refs
(CA-8316; ISBN-0902937-88-X) Avail: NTIS HC A04/MF A01

The stability of burner flames for arbitrary Lewis number is considered on the basis of large activation energy modelling. Previous leading-order-only approaches are now extended to second order in theta (sub 1) (the inverse activation energy). The assumption that the unsteady perturbations are small (order epsilon) means that the distinguished limit implicit in the product must be discussed. Different governing equations (and in particular the inner zone equation) are obtained in the two cases, theta (sub 1) epsilon yields 0 and theta (sub 1) epsilon yields infinity. There are two important complex frequency relations governing the behavior of flames near burners and it is readily seen that the now classical free flame dispersion relation is derived as a special case for flames with infinite stand-off distance, and Lewis number close to unity. Author

N84-15219# Cranfield Inst. of Tech., Bedfordshire (England). College of Aeronautics.

SECOND ORDER THEORY OF UNSTEADY BURNED-ANCHORED FLAMES WITH ARBITRARY LEWIS NUMBER

A. C. McIntosh and F. J. Clarke May 1983 38 p refs
(CA-8313; ISBN-0902937-89-8) Avail: NTIS HC A03/MF A01

Three theoretical models of plane flames burning on a cooled porous plug type of flame holder are reviewed and compared with experimentally observed relationships between stand off distance, flame speed and temperature. For most practical burners their conductance is large and for near adiabatic conditions, the order of the nondimensional stand off distance ceases to be O(1), but is O(ln theta) where theta is the nondimensional activation energy. Author

N84-15220# State Univ. of New York, Buffalo. Dept. of Chemistry.

POLYMER COATED ELECTRODES IN AMBIENT TEMPERATURE MOLTEN SALTS

P. G. Pickup and Robert A. Osteryoung 1 Aug. 1983 5 p
(Contract N00014-79-C-0682)
(AD-A133202; AD-E000546; SUNYBUF/DC/TR-14) Avail: NTIS HC A02/MF A01 CSCL 07/2

Ambient temperature molten salts, specifically the N-n-butylpyridinium chloride aluminum chloride system, have been shown to be useful solvents for studying polymer films on solid electrodes. The electrochemical behavior of (Ru(2,2'-bipyridine)2 (4-vinylpyridine)2)2+, polyvinylferrocene and thionine polymers have been investigated in basic, neutral and acidic melts. Behavior is similar to that reported for these polymer films in other non aqueous solvents, such as acetonitrile, or water, and may be somewhat enhanced. GRA

N84-15221# Ballistic Research Labs., Aberdeen Proving Ground, Md.

TRANSPORT ALGORITHMS FOR METHANE FLAMES Final Report

Joseph M. Heimerl and Terence P. Coffee Jul. 1983 33 p
(DA Proj. 1L1-61102-AH-43)
(AD-A133213; AD-F300312; ARBRL-TR-02512) Avail: NTIS HC A03/MF A01 CSCL 21/2

The effects of three different methods of approximating multispecies transport phenomena in models of premixed, laminar, steady state flames have been studied. The most precise, the most simple and a compromise transport algorithm were used to model methane oxygen flames at one atmosphere with diluents of nitrogen, argon or helium. The thermodynamic and Lennard-Jones (Stockmayer) coefficients for individual species were held fixed together with the kinetic network and rate coefficients. Only the computational algorithms were changed. Within factors of 10-20% we found that the computed flame speeds and species and temperature profiles were independent of the algorithm employed. Since we have previously reported a similar independence for hydrogen-oxygen-nitrogen flames, we infer that this result is a general one. GRA

N84-15222# Ohio State Univ., Columbus.

EFFECT OF UV ILLUMINATION ON THE SUBLIMATION OF BASAL SURFACES OF ZINC OXIDE

D. A. Carey, R. A. Rapp, and J. P. Hirth Nov. 1983 11 p
(Contract N00014-75-C-0541)
(AD-A133383; OSURF-TR-25) Avail: NTIS HC A02/MF A01 CSCL 07/4

Despite substantial agreement in the measured kinetics for the sublimation of basal surfaces of zinc oxide crystals, differing mechanisms have been proposed. To help resolve the questions, the effect of photoexcitation on the ZnO basal plane sublimation rate was studied. Single crystals were illuminated by ultra-violet irradiation of 0.177 mW/sq mm, or 4 photons/site-sec. Three wave lengths between 300-375 nm gave the same result, i.e., a small decrease in rate for the (0001) surface, and a small increase for the (0001) surface. This result supports the model for surface charge effects resulting from oppositely charged surface kinks by Hirth et al, and opposes the model for rate control by charge recombination at surface sites by Kirschwald, et al. GRA

N84-15223# Florida Univ., Gainesville. Dept. of Materials Science and Engineering.

ELECTRICALLY CONTROLLED COLORATION OF MATERIALS Final Report, 1 Nov. 1979 - 30 May 1983

Paul H. Holloway 31 Aug. 1983 12 p
(Contract DAAG29-80-C-0007)
(AD-A133420; ARO-16492.3-PH) Avail: NTIS HC A02/MF A01 CSCL 07/4

A select number of solid materials will change color in the visible region of light when an electric field is applied. This phenomenon has been termed electrochromism and it has been the subject of this investigation. GRA

N84-15224# Texas A&M Univ., College Station. Dept. of Chemistry.

LUMINESCENCE PROBE STUDIES OF NAFION POLYELECTROLYTES

Nelson E. Prieto and Charles R. Martin 7 Oct. 1983 31 p
Presented at Meeting of the Electrochem. Soc. (163rd), San Francisco, 12 May 1983 Submitted for publication
(Contract N00014-82-K-0612; NR Proj. 627-838)
(AD-A133519; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

We have recently described a procedure for dissolving perfluorosulfonate ionomer membranes. This allows, for the first time, for a study of the inherent chemical properties of the polyperfluorosulfonate molecule. Such studies of the free polyelectrolyte molecule in solution should give insight into the chemical properties of the solid state membranes obtained from these polyelectrolytes. The work described here focusses on investigations of the nature of the interactions between the polyperfluorosulfonates and their counterions. Clearly an electrostatic interaction is extant but because hydrophobic interactions have been implicated in various studies of perfluorosulfonate membranes, it was of interest to see if evidence for such interactions could be observed in solutions of the polyelectrolytes. Luminescence probe studies were used to investigate the nature of the interactions between the polyperfluorosulfonates and their counterions. GRA

N84-15225# North Carolina Univ., Chapel Hill.

THE CHEMISTRY OF TRANSITION METAL CARBENE COMPLEXES Final Technical Report

G. Ronald Husk and M. S. Brookhart 20 Aug. 1983 24 p
(Contract DAAG29-79-D-1002)
(AD-A133541; ARO-18782.5-CH) Avail: NTIS HC A02/MF A01 CSCL 07/3

Significant contributions to the understanding of the synthesis, structure and reactivity of d4 and d6 metal carbene complexes of the type Cp(CO)(L)Fe=CHR+ (R=aryl, alkyl; L=P(C6H5)3, CO) and Cp(CO2)LM=CHR+ (M=Mo,W; R=H, aryl) are described. The increasing interest in these complexes can be attributed to their unique reactivity patterns and to their potential importance as intermediates in catalytic processes (olefin metathesis, polymerization and carbene transfer reactions). Recent studies of the

cyclopropanation of styrene have provided an excellent model for establishing the role of metal chirality in the conversion of prochiral substrates into optically-active products. GRA

N84-15226# California Univ., Livermore. Lawrence Livermore Lab.
CHEMICAL KINETICS MODELING OF ENGINE KNOCK: PRELIMINARY RESULTS
William J. Pitz and Charles K. Westbrook 27 Sep. 1983 39 p refs Presented at the Combustion Inst. Fall Meeting of the Western States Section, Los Angeles, 17 Oct. 1983
(Contract W-7405-eng-48)
(DE84-001236; UCRL-89861; CONF-8310201-1) Avail: NTIS HC A03/MF A01

A theoretical model, including a detailed kinetic mechanism for propane oxidation, is used to examine the ignition of propane-air mixtures under conditions of pressure and temperature encountered in knocking engines. Purely kinetic calculations are used to evaluate relative time scales for the fuel-air ignition process, varying the initial pressure, temperature, and fuel-air equivalence ratio. A one dimensional model is then used to examine the combined effects of flame propagation, homogeneous ignition, and wall heat transfer on the autoignition of these mixtures. For the temperatures and pressures on concern in this study, it is found that the reaction mechanism is controlled by reactions of the hydroperoxyl radical, in contrast with similar mechanisms at higher temperatures and lower pressures. The time scales computed indicate that, in agreement with experimental evidence, propane-air ignition delay times are slightly longer than the relevant residence times in the end gases of a practical engine and that propane-air mixtures will therefore be quite resistant to knock. DOE

N84-15227# Mound Lab., Miamisburg, Ohio.
QUANTITATIVE DETERMINATION OF HYDROGEN BY PULSED NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY
Albert Attalla and Robert C. Bowman, Jr. 1983 8 p refs Presented at the 26th ORNL-DOE Conf. on Anal. Chem. in Energy Technol., Knoxville, Tenn., 11 Oct. 1983
(Contract DE-AC04-76DP-00053)
(DE84-002831; MLM-3112(OP); CONF-831025-23) Avail: NTIS HC A02/MF A01

Hydrogen can be determined routinely in solids and liquids by pulsed nuclear magnetic resonance (NMR) when the proton spin-spin relaxation time is relatively long > 20 SIGMA sec) and the proton spin-lattice relaxation time is relatively short (> 100 sec). Short spin-spin relaxation times result in intolerable loss in signal amplitude due to short-lived free-induction-decay signals. Long spin-lattice relaxation times lengthen the analysis time by lengthening the delay time between successive pulses during data accumulation. The technique is nondestructive and requires only a few milligrams of sample for solutions, and approximately 100 to 500 mg for direct analyses of solid samples. The precision (relative to the average value, and the accuracy varies from +- 2 to +-5% depending on the relaxation time parameters and size of the sample. The accuracy can be improved by the method of standard additions of hydrogen and by providing standard samples which reflect the physical and chemical properties of the analytical samples. The technique was applied to the determination of moisture in solids and liquids, to the determination of hydrogen stoichiometry in solid metal hydrides, impurity analyses, compound identification, and molecular structure confirmation. DOE

N84-15228# Bureau of Mines, Rolla, Mo.
CHEMICAL VAPOR DEPOSITION OF GROUP IVB, VB, AND VIB ELEMENTS WITH NONMETALS. A LITERATURE REVIEW
Hector O. McDonald and James Blake Stephenson May 1983 36 p
(PB83-225409; BM-IC-8928; LC-83-600000) Avail: NTIS HC A03/MF A01 CSCL 07A

The nonmetal binary and ternary compounds of the group IVB, VB, and VIB elements was surveyed with emphasis on B, C, N, O, and Si. Each of these binary and selected ternary compounds of the group IVB, VB, and VIB elements were examined as coatings and some of their preparative methods, uses, and properties are given. A total of 259 references were found for these compounds of the nine elements. Application as abrasion-, erosion-, and corrosion-resistant coatings in order to conserve critical metals and protect various metallic surfaces in metallurgical, mining, and energy conversion systems is mentioned. Author

N84-15229# Environmental Research Lab., Athens, Ga.
INCREASED CONFIDENCE IN SPECTRUM MATCHING BY USE OF A RETENTION TIME LIBRARY
Walter M. Shackelford 1983 23 p refs
(PB83-232090; EPA-600/D-83-084) Avail: NTIS HC A02/MF A01 CSCL 07D

The reliability of computer aided spectrum matching in compound identification was tested. Some 4000 samples of wastewater from 21 industrial categories and finished water from publicly owned treatment works were analyzed. Mass intensity, and retention data were used to narrow the choices the identification. It is shown that the confidence of automated spectra matches can be increased by using retention data as a match parameter. J.M.S.

N84-15230 California Inst. of Tech., Pasadena.
NONLINEAR ACOUSTICS INSTABILITIES IN COMBUSTION CHAMBERS Ph.D. Thesis
Elias Atieh Awad 1983 303 p
Avail: Univ. Microfilms Order No. DA8321008

Following a second order expansion in the pressure amplitude, analytical expressions for the amplitude and the conditions for existence and stability of limit cycles for pressure oscillations in combustion chambers are shown. Two techniques are used. The first technique is an asympotic perturbation technique where the asymptotic oscillatory behavior is sought by expanding the asymptotic solution in a measure of the amplitude of the wave, mainly the amplitude of the fundamental. The second technique is a perturbation averaging technique where an approximate solution is sought by applying a perturbation method followed by an expansion of the solution in the normal modes of the acoustic field in the chamber. It is shown, to third order in the amplitude of the wave, that both techniques yield the same results regarding the amplitude and the conditions for existence and stability of the limit cycle. However, while the first technique can be extended to higher orders in the pressure amplitude, the second technique suffers serious difficulties. The advantage of the second technique is in its ability to handle easily a large number of modes.
Dissert. Abstr.

N84-15189# Council for Scientific and Industrial Research, Pretoria (South Africa).
ANALYTICAL CHEMISTRY
In its Activities of the National Chemical Research Lab. 1982 p 7-17 refs (For primary document see N84-15188 06-23)
Avail: NTIS HC A07/MF A01

N84-15192# Council for Scientific and Industrial Research, Pretoria (South Africa).
INORGANIC CHEMISTRY
In its Activities of the National Chemical Research Lab. 1982 p 51-61 refs (For primary document see N84-15188 06-23)
Avail: NTIS HC A07/MF A01

N84-15303# Perkin-Elmer and Co. G.m.b.H., Munich (West Germany). Physical Electronics Div.
EXPERIENCE IN SURFACE ANALYSIS APPLIED TO TECHNICAL MATERIAL PROBLEMS
H. Goretzki *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 39-47 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15304# Port Elizabeth Univ., Cape Province (South Africa). Dept. of Physics.
SURFACE PHOTOLUMINESCENCE AND IT APPLICATION
H. Booyens and J. H. Basson *In* Natl. Phys. Res. Lab. Proc. of

Symp. on Surface Sci. and its Ind. Implications 1981 p 49-53 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15316# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Physics.
OXYGEN ADSORPTION AND INITIAL OXIDATION OF SINGLE CRYSTAL FIRST ROW TRANSITION METAL AND ALLOY SURFACES
J. P. Roux *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 157-167 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15319# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Physics.
SURFACE SEGRATION AND DIFFUSION INVESTIGATIONS BY MEANS OF AES
P. E. Viljoen, F. Bezuidenhout, J. duPlessis, J. A. J. Lourens (Randse Afrikaanse Univ.), G. L. P. Berning, and J. P. Roux *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 187-193 refs Sponsored in part by CSIR and the Research Fund of the UOFS (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15324# National Inst. for Metallurgy, Randburg (South Africa).
SPECTROSCOPIC STUDIES ON SURFACE REACTIONS BETWEEN MINERALS AND REAGENTS IN FLOTATION SYSTEMS
E. W. Giesekke *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 229-235 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15325# Pretoria Univ. (South Africa). Dept. of Chemistry.
THE HETEROGENEOUS NUCLEATION OF ICE I
J. C. Davidtz and P. L. Mouton *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 239-245 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-16057*# Calhoun Community Coll., Decatur, Ala.
EVALUATION OF THE SEPARABILITY OF MONODISPERSE POLYSTYRENE LATEX MICROSPHERES IN A CONTINUOUS FLOW ELECTROPHORESIS SYSTEM
George Williams, Jr. *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 16 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N84-15231# British Library Lending Div., Boston Spa (England).
POWDER METALLURGY
7 Oct. 1983 8 p Transl. into ENGLISH from Stal (USSR), no. 1, 1983 p 69-71
(BLL-M-35271-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

An overview is presented of an exhibition devoted to the latest achievements and prospects of development of powder metallurgy in the U.S.S.R.. Some methods of producing powders from ferrous and nonferrous metals and alloys are examined as well as methods of producing composite materials and articles from these powders. Different applications of powder materials are considered. A.R.H.

N84-15232# British Library Lending Div., Boston Spa (England).
INFLUENCE OF ALLOYING ON THE PROPERTIES OF NICKEL IN THE SOLID AND LIQUID STATES
V. I. Kozar, N. N. Petrov, L. Ya. Kozlov, L. M. Romanov, and O. V. Kostygova 7 Nov. 1983 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chernaya Metall. (USSR), no. 1, 1983 p 6-8
(BLL-M-35284-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The concentration dependence of the viscosity and strength characteristics of binary nickel alloys containing up to 15% (atom.) Fe, Cr, Mo, W or Nb has been investigated. A correlation was found between the change in properties of the binary alloys in the solid and liquid states. In order of increasing effect of alloying on the melt viscosity at a constant superheat above the liquidus line and the strengthening of the solid solution the alloying elements form the following series: Fe - Cr - Mo - W - Nb. The test alloys were prepared in a vacuum induction furnace and cast into moulds made by the lost-wax process and preheated to 800 C. Author

N84-15233# British Library Lending Div., Boston Spa (England).
STABILITY OF MECHANICAL PROPERTIES OF COLD-DRAWN ROLLED METAL WITH HIGH-TEMPERATURE THERMO-MECHANICAL TREATMENT
V. T. Zhadan, A. M. Petrenko, V. A. Trusov, A. N. Voronov, and I. E. Oratovskaya 7 Oct. 1983 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Chernaya Met. (USSR), no. 1, 1983 p 92-96
(BLL-M-35292-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The influence of chemical composition within standard limits on variation in the mechanical properties of a cold-drawn section of steel 45 was investigated using experiment design methods. The influence of the technological factors of rolling feedstock of steel 45 with HTMT on the mechanical properties of the section is discussed. An algorithm of stabilization of mechanical properties is examined. Author

N84-15234# British Library Lending Div., Boston Spa (England).
CALCULATION OF STRUCTURE FACTOR FOR DIFFERENT CLUSTER MODELS OF AN AMORPHOUS ALLOY
E. V. Shelekhov, N. V. Edneral, and Yu. A. Skakov 7 Oct. 1983 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chernaya Met. (USSR), no. 1, 1983 p 96-102
(BLL-M-35293-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

A method is proposed for calculating the structure factor on the basis of a model of the micro-heterogeneous structure of an amorphous metal in the form of a quasi-alloy of clusters with individual atoms. Recording of clusters - atoms coherent scattering enables the structure factor to be constructed in the small angles region. With 30% to 40% of atoms in clusters, a cluster diameter of 10 to 15 A, and a close packed cluster structure, the calculated structure factor reproduces the main features of the sample studied. Author

N84-15235# United Kingdom Atomic Energy Authority, Windscale (England).
CORROSION OF TIG WELDED AUSTENITIC STAINLESS STEELS
G. Edling 18 Aug. 1983 11 p refs Transl. into ENGLISH from Svetsen (Sweden), v. 38, no. 3, May 1979 p 61-63
(BLL-WINDSCALE-Tr-959-(9091.F)) Avail: British Library Lending Div., Boston Spa, Engl.

Several cases of pitting were encountered in or adjacent to assemblage welds mainly in pipes for tap water or brackish water. The corrosion appears to have been caused by oxides that are formed in welding with insufficient root gas shielding. Corrosion testing of stainless pipes which were TIG welded using different types and qualities of root shielding gas, show that it is essential to limit the O2 concentration in the root shielding gas to very low values. A maximum of 25 ppm O2 is permissible in order to avoid reduced corrosion resistance in the weld and the heat-affected zone. In addition, the gas shielding must be kept intact until the weld has cooled down to below 300 C in order to avoid harmful oxidation. In cases where the root gas shielding is insufficient, the

oxides must be removed. Tests using different mechanical and chemical methods of cleaning indicate that a pitting resistance which is equivalent or superior to unaffected parent metal is obtained if all visible oxide is removed. Author

N84-15236# British Library Lending Div., Boston Spa (England).
COMPARATIVE STUDY OF TIN HARD COATINGS PRODUCED BY REACTIVE SPUTTERING, ION-PLATING AND CVD TECHNIQUE
Helmut Freller, Heinrich Haessler, and Horst Schreiner 6 Sep. 1983 9 p Transl. into ENGLISH from High Temp. High Pressures (England), v. 14, 1982 p 335-340 Presented at the 10th Plansee Seminar, Reutte, Austria, 1-5 Jun. 1981
(BLL-RARDE-Tr-1094(7291.7965)) Avail: British Library Lending Div., Boston Spa, Engl.

Chemical vapor deposition (CVD) techniques applied to the coating of tools and structural parts are discussed. For certain applications, coating temperatures of around 1000 C, typical of the CVD process, are too high. For this reason an attempt was made to deposit titanium nitride hard coatings by PVD methods; in plating and sputtering. Because of the appreciably lower deposition temperatures, 200-400 C and the different way the compound forms, the structure of such coatings differs from that of CVD coatings. These were investigated by optical microscopy, scanning electron microscopy, and Vickers hardness measurements. In addition, the influence of specimen geometry on film thickness and film quality is briefly discussed. R.J.F.

N84-15237# Electricity Council, London (England).
DIFFUSION FILMS PRODUCED BY HEAT TREATMENT OF ELECTROPLATED COATINGS
H. Winterhager and W. Krajewski 4 Oct. 1983 29 p refs Transl. into ENGLISH from Metallkunde Aspekte Galvanotech. Symp. (West Germany), 1978 p 81-98 Symp. held in Berlin, West Germany, 1978
(BLL-OA-Trans-3082-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

The fundamentals of solid diffusion are reviewed as well as the practical benefits of the diffusion annealing of electrolytically applied lasers. Problems associated with diffusion behavior and the secondary effects of diffusion heat treatments are examined. Examples of diffusion annealed electroplated coatings discussed include: gold plated Arentan; nickel plated uranium aluminum alloys; brass with an electroplated nickel film and tinned; and electroplated nickel phosphorus layers for enhancing wear and corrosion resistance. The equipment used for diffusion annealing is also described. A.R.H.

N84-15238# Electricity Council, London (England).
POTENTIOSTATIC INVESTIGATION OF THE KINETICS OF THE BREAKDOWN OF THE PASSIVITY OF ALUMINIUM IN AQUEOUS MEDIUM
A. Ben Rais, F. Dalard, and J. Guiton 4 Oct. 1983 18 p refs Transl. into ENGLISH from Surface Technol. (Switzerland), v. 12, 1981 p 231-244
(BLL-OA-Trans-3066-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

The value of the passivity breakdown potential e(n) of aluminum was determined at constant potential, using aluminum supporting an oxide film with reasonably well known thickness and structure, as a function of the nature and concentration of ions, the solution pH, the temperature, the metal structure (monocrystalline or polycrystalline) and the thickness of the oxide film. When the concentration of the aggressive anion is low in the electrolyte, the kinetics of passivity breakdown seem to be limited by the anion adsorption step and interstitial diffusion into the oxide. When the ion concentration is high, e(n) varies with the nature of the anion and seems to depend only on adsorption of the anion at the external interface. The e(n) values are little influenced by the thickness of the oxide film and the metal structure. Author

N84-15239# Electricity Council, London (England).
CHOICE OF A MELTING INSTALLATION FOR ALUMINUM ALLOY
P. Foisy and J. Guillermet 21 Oct. 1983 15 p Transl. into ENGLISH from Hommes et Fonderie (France), no. 11, Nov. 1979 p 26-29
(BLL-OA-Trans-3095-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.

The selection of a furnace for a foundry where aluminum alloys are pressure cast for automobile parts is discussed. The advantages and inconveniences of a gas furnace and of electric furnaces with and without bulk holding are examined. Factors considered include investment costs and payments; operating costs including labor, energy, relining, and rejects and alterations; and technical possibilities. The effects of each system on working conditions and the environment are compared as well as the economy of operation over a 16 yr period. The system chosen has a 3 crucible induction furnace working at supply frequency (without bulk holding) for melting the ingots and two electric preheaters for drying the ingots and the recoverable material. A.R.H.

N84-15240# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. Materials Technology Div.
COMPARISON OF FRACTURE-TOUGHNESS MEASUREMENTS FROM FERRITIC-STEEL COMPACT-TENSION AND SURFACE-FLAWED SPECIMEN
W. G. Reuter 1983 13 p refs Presented at the 7th Intern. Conf. on Structural Mech. in Reactor Technol., Chicago, 22 Aug. 1983
(Contract DE-AC07-76ID-01570)
(DE84-000895; EGG-M-04883; CONF-830805-60) Avail: NTIS HC A02/MF A01

Calculations of predicted values of stress for initiation of crack growth were made for 6.4 and 12.7 mm thick surface-flawed specimens using either the ASME Boiler and Pressure Vessel Code approach or that of Newman-Raju for calculating the front and back face correction terms. The results show the ratio of the two stresses to range from 0.8 to 1.4 which indicates that neither approach is consistently more conservative. A comparison between experimentally-determined stresses and predicted stresses showed substantial differences between the Code approach and that of Newman-Raju. The ratio of experimentally-determined stresses to predicted stresses ranged from 0.78 to 1.55 and from 0.85 to 1.188 for the Code approach and that of Newman-Raju, respectively. The amount of conservatism appears to be nominally a function of cF(2), a term that quantifies the severity of surface flaws. It is recommended that the Newman-Raju approach for calculating the stress intensity for surface flaws be used instead of that suggested in the Code. DOE

N84-15241# Overseas Relations Branch Translation Service, London (England).
A MELT FOR THE ELECTROLYTIC APPLICATION OF TITANIUM PLATING
N. Kh. Tumanova, N. M. Sarnavskii, M. U. Prikhodko, A. V. Chetverikov, L. V. Bogdanovich, and I. M. Mukha Oct. 1983 6 p Transl. into ENGLISH of Russian Patent no. 876800 (19 Oct. 1979)
(BLL-OA-Trans-3111-(6196.3)) Avail: NTIS HC A02/MF A01

The invention concerns the application of refractory metals from melts, and especially titanium plating, and is employed in instrument manufacture, machine building and other branches of industry. Author

N84-15242# Council for Scientific and Industrial Research, Pretoria (South Africa).
PRECIPITATION OF METALS FROM SOLUTIONS BY BASER METALS
I. N. Plaskin 1983 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekh. Nauk (USSR), no. 1, 1948 p 131-138
(CSIR-1712) Avail: NTIS HC A02/MF A01

The effects of various physiochemical factors on the precipitation of gold from a cyanide solution by zinc was investigated experimentally. The observed relationships between precipitation

rate, intensity of mixing of the solution, and temperature indicate that the essential determinant is diffusion rate, with the result that the introduction of the precipitator via the filtration layer gives a considerably faster reaction than suspension of the precipitator in the mixing solution. Oxygen (dissolved in water) is reduced on the cathode portion of the zinc element and forms complex compounds. The process of zinc dissolution in the cyanide solution accompanying the basic cementation reaction was also investigated and a correlation established between dissolution rate and alkali and cyanide concentration, with an increase in the latter resulting in higher dissolution rates, whereas an increase in the concentration of certain admixtures (copper, sulfur compounds) results in slower dissolution. A.R.H.

N84-15243# Council for Scientific and Industrial Research, Pretoria (South Africa).
OBSERVATIONS ON THE VANADIUM-NITROGEN SYSTEM AND ON PURE METALLIC VANADIUM
G. Brauer and W.-D. Schnell 1983 10 p refs Transl. into ENGLISH from J. of Less-Common Metals (West Germany), v. 6, 1964 p 326-332
(CSIR-Trans-1708) Avail: NTIS HC A02/MF A01

The existing published data on the phases of the vanadium-nitrogen system were re-examined, and new values presented for phase boundary nitride composition and nitride lattice constants. The nitrogen dissociation pressures of the cubic phase VNo, sub 72 and the hexagonal phase VNo, sub 43 were measured between 1300 and 1600 C. A sample of very pure vandium was prepared by heating the metal in a high vacuum at 1650 C. Author

N84-15244# United Kingdom Atomic Energy Authority, Risley (England).
EMBRITTLEMENT OF STEELS DUE TO GALVANIZING OR COATING WITH ZINC PAINT: AN INVESTIGATION OF EMBRITTLEMENT IN WELDING OR HEATING OPERATIONS
K. Minoda, I. Kawashima, Y. Tomisawa, and K. Sonoya 1983 22 p refs Transl. into ENGLISH from Ishikawajima Harima Giho (Japan), v. 21, no. 3, p 193-199
(AERE-TR-4774) Avail: NTIS HC A02/MF A01

Zinc embrittlement in the welding and heat treatment of stainless steel, high tensile steel, and mild steel was investigated. On welding galvanized steels or steels coated with zinc rich primer, the zinc melts and weld cracking may occur. Susceptability to zinc embrittlement cracking differs with the materials: SUS304 and HT80 have a high susceptability. On the other hand, SS41 has low susceptability, with little risk of weld cracking. When steel coated with zinc is heated, the zinc in the coating melts and diffuses into the steel, forming a zinc alloy layer of poor ductility. Surface cracks develop when the material is subsequently stressed by bending. Crack depth decreased in the order SUS304 > HT80 > SS41, corresponding to the order of weld crack susceptability. A.R.H.

N84-15245# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Environmental Analysis and Planning Div.
ENVIRONMENTAL BEHAVIOR OF TECHNETIUM-99
Marie-Daniele S. Turcotte [1983] 63 p refs
(Contract DE-AC09-76SR-00001)
(DP-1644) Avail: NTIS HC A04/MF A01

The chemical and physical properties of some technetium compounds are considered, and possible source terms are discussed. Literature on the environmental behavior of technetium is presented, including its behavior in the bodies of animals and humans. Author

N84-15246*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF CO2 AND CO DOPANTS IN HYDROGEN TO REDUCE HYDROGEN PERMEATION IN THE STIRLING ENGINE HEATER HEAD TUBE ALLOY CG-27 Final Report
John A. Misencik Jul. 1983 34 p refs
(Contract DE-AI01-77CS-51040)
(NASA-TM-83535; E-1901; DOE/NASA/51040-50; NAS 1.15:83535) Avail: NTIS HC A03/MF A01 CSCL 11F

Tubes of CG-27 alloy, filled with hydrogen doped with various amounts of carbon dioxide and carbon monoxide, were heated in a diesel fuel fired Stirling engine simulator materials test rig for 100 hours at 820 C and at a gas pressure of 15 MPa to determine the effectiveness of the dopants in reducing hydrogen permeation through the hot tube wall. This was done for clean as-heat treated tubes and also for tubes that had previously been exposed for 100 hours to hydrogen doped with 1.0 volume percent carbon dioxide to determine if the lower levels of dopant could maintain a low hydrogen permeation through the hot tube wall. Carbon dioxide, as a dopant in hydrogen, was most effective in reducing hydrogen permeation through clean tubes and in maintaining low hydrogen permeation after prior exposure to 1.0 volume percent carbon dioxide. Only the lowest level of carbon dioxide (0.05 volume percent) was not as effective in the clean or prior exposed tubes. Carbon monoxide as a dopant in hydrogen was less effective than carbon dioxide at a given concentration level. Of the four dopant levels studied; 1.0, 0.5, 0.2, and 0.05 volume percent carbon monoxide, only the 1.0 and 0.5 volume percent were effective in reducing and maintaining low hydrogen permeation through the CG-27. Author

N84-15247*# Garrett Turbine Engine Co., Phoenix, Ariz.
LOW-COST SINGLE-CRYSTAL TURBINE BLADES, VOLUME 1 Final Report
T. E. Strangman, B. Heath, and M. Fujii Nov. 1983 218 p refs
(Contract NAS3-20073)
(NASA-CR-168218; GARRETT-21-4314-1; NAS 1.26:168218) Avail: NTIS HC A10/MF A01 CSCL 11F

The exothermic casting process was successfully developed into a low cost nonproprietary method for producing single crystal (SC) castings. Casting yields were lower than expected, on the order of 20 percent, but it is felt that the casting yield could be significantly improved with minor modifications to the process. Single crystal Mar-M 247 and two derivative SC alloys were developed. NASAIR 100 and SC Alloy 3 were fully characterized through mechanical property testing. SC Mar-M 247 shows no significant improvement in strength over directionally solidified (DS) Mar-M 247, but the derivative alloys, NASAIR 100 and Alloy 3, show significant tensile and fatigue improvements. The 1000 hr/238 MPa (20 ksi) stress rupture capability compared to DS Mar-M 247 was improved over 28 C. Firtree testing, holography, and strain gauge rig testing were used to evaluate the effects of the anisotropic characteristics of single crystal materials. In general, the single crystal material behaved similarly to DS Mar-M 247. Two complete engine sets of SC HP turbine blades were cast using the exothermic casting process and fully machined. Author

N84-15248*# National Aeronautics and Space Administration, Washington, D. C.
TRICHITE GROWTH DURING OXIDATION OF TITANIUM AND TA6V4 ALLOY BY WATER VAPOR AT HIGH TEMPERATURES
Christian Coddet, Francoise Motte, and Pierre Sarrazin Aug. 1982 7 p Transl. into ENGLISH from Sci. Chim. (France), v. 281, no. 13, 29 Sep. 1975 p 507-510 Original language document was announced as A76-11974 Transl by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-76974; NAS 1.15:76974) Avail: NTIS HC A02/MF A01 CSCL 11F

Analysis by electron scanning microscope detected the formation of rutile trichites on the surface of specimens of titanium and titanium alloy TA6V4 oxidized in water vapor in the temperature range 650 to 950 C and the water vapor pressure range from 0.5 to 18 torr. In all specimens, two sublayers of rutile were formed: an external layer of basalt-like appearance, and a microcrystalline inner layer. Morphology of the trichites depends on temperature and the material (whether metal or alloy), but not on vapor pressure. Author

N84-15249*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TENSILE AND COMPRESSIVE CONSTITUTIVE RESPONSE OF 316 STAINLESS STEEL AT ELEVATED TEMPERATURES
S. S. Manson (Case Western Reserve Univ.), U. Muralidharan, and G. R. Halford (Case Western Reserve Univ.) 1982 26 p refs Presented at the Symp. on Nonlinear Constitutive Relations for High Temp. Appl., Akron, Ohio, 19-20 May 1982; sponsored by Akron Univ. and NASA Previously announced as N83-34353
(NASA-TM-83506; NAS 1.15:83506) Avail: NTIS HC A03/MF A01 CSCL 11F

It is demonstrated that creep rate of 316 SS is lower by factors of 2 to 10 in compression than in tension if the microstructure is the same and tests are conducted at identical temperatures and equal but opposite stresses. Such behavior was observed for both monotonic creep and conditions involving cyclic creep. In the latter case creep rate in both tension and compression progressively increases from cycle to cycle, rendering questionable the possibility of expressing a time-stabilized constitutive relationship. The difference in creep rates in tension and compression is considerably reduced if the tension specimen is first subjected to cycles of tensile creep (reversed by compressive plasticity), while the compression specimen is first subjected to cycles of compressive creep (reversed by tensile plasticity). In both cases, the test temperature is the same and the stresses are equal and opposite. Such reduction is a reflection of differences in microstructure of the specimens resulting from different prior mechanical history. B.W.

N84-15250# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
RAPID SOLIDIFICATION PROCESSING AND POWDER METALLURGY OF AL ALLOYS Annual Report, 15 Apr. 1982 - 14 Apr. 1983
Hamish L. Fraser 19 Sep. 1983 68 p
(Grant AF-AFOSR-0186-82; AF Proj. 2306)
(AD-A133873; AFOSR-83-0826TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

During the first period of performance, three tasks have been undertaken. These involve first a study of the specific microstructural changes that accompany rapid solidification of a number of Al alloys together with a determination of the thermal stability of these microstructures, second the production of rapidly solidified particulate and third the use of dynamic powder compaction (DPC) for the consolidation of rapidly solidified particulate in the absence of prolonged thermal excursions. A number of alloys have been rapidly solidified using laser surface melting and melt-spinning and in each case the observed microstructure has been interpreted in terms of the undercooling achieved during processing. Rapidly solidified (gas atomized) powders of 7091 have been consolidated using DPC. Is has been shown that bulk samples may be produced that are close to theoretical density. GRA

N84-15251# Northrop Corp., Hawthorne, Calif. Aircraft Div.
INVESTIGATION OF FATIGUE CRACK-GROWTH RESISTANCE OF ALUMINUM ALLOYS UNDER SPECTRUM LOADING Final Report, 1 Oct. 1981 - 30 Nov. 1982
G. V. Scarich and P. E. Bretz Apr. 1983 187 p
(Contract N00019-81-C-0550)
(AD-A133206; AD-E000546; NOR-83-84) Avail: NTIS HC A09/MF A01 CSCL 11/6

The purpose of this program is to obtain metallurgical guidelines and test methodologies for selection and development of spectrum fatigue resistant, high strength aluminum alloys for application to aircraft structures. Described in this report are the results of baseline characterizations of ten high strength aluminum alloys. Also described are results of fatigue crack growth tests under two F-18 load spectra and under modifications of these spectra. GRA

N84-15252# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.
THE NATURE OF QUASICLEAVAGE FRACTURE IN TEMPERED 5.5 ni STEEL AFTER HYDROGEN CHARGING
Y. H. Kim and J. W. Morris, Jr. Oct. 1982 25 p
(Contract N00014-75-C-0154)
(AD-A133460; TR-12) Avail: NTIS HC A02/MF A01 CSCL 11/6

Quenched and tempered 5.5Ni steel was embrittled by hydrogen charging and broken in air at room temperature. The primary fracture mode was transgranular quasicleavage. The quasicleavage facets were studied by scanning electron fractography and by transmission electron microscopy of profile fractographic specimens. The latter were prepared by plating the fracture surface with nickel and thinning so that the fracture surface was contained within the region of the specimen that was transparent to the electron beam. The fracture surface generally followed martensite lath boundaries. In addition, interlath microcracks were frequently found in the material immediately beneath the fracture surface. These results suggest that transgranular hydrogen embrittlement in this steel is primarily an interlath cracking phenomenon. Since the lath boundary planes tend to lie in (110), the results also explain the pervelance of (110) quasicleavage in the embrittled specimens, which contrasts with the (100) cleavage found in uncharged specimens broken below the ductile-to-brittle transition temperature. GRA

N84-15253# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
ELEVATED TEMPERATURE LOW CYCLE FATIGUE OF NICKEL BASE SUPERALLOYS IN THE CONVENTIONALLY CAST, DIRECTIONALLY SOLIDIFIED AND SINGLE CRYSTAL FORMS Final Report, 1 Jan. 1980 - 30 Jun. 1983
Stephen D. Antolovich Aug. 1983 61 p
(Grant AF-AFOSR-0065-80; AF Proj. 2306)
(AD-A133598; AFOSR-83-0827TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

High temperature low cycle fatigue (LCF) has been studied for directionally solidified (DS) and conventionally cast (CC) Rene' 80. For the conventionally cast material testing was carried out on smooth bars over the temperature range 75 F (24 C) to 1800 F (982 C). It was found that at low temperatures slip was planar and carbides acted as crack initiation sites. In correspondence with the importance of carbides on the fatigue life it was found that life correlated best with total strain range (as opposed to plastic strain range). GRA

N84-15254# Hanford Engineering Development Lab., Richland, Wash.
DESIGN AND USE OF NONSTANDARD TENSILE SPECIMENS FOR IRRADIATED MATERIALS TESTING
N. F. Panayotou, S. D. Atkin, and R. J. Puigh Aug. 1983 16 p Presented at the Symp. on the Use of Nonstandard Subsized Specimens for Irradiated Testing, Albuquerque, N. Mex., 23 Sep. 1983
(Contract DE-AC06-76FF-02170)
(DE84-001468; HEDL-SA-2984-FP; CONF-8309170-4) Avail: NTIS HC A02/MF A01

Two types of miniature specimens have been developed to utilize the limited irradiation volume of high energy neutron sources such as the Rotating Target Neutron Source (RTNS)-II and the Fusion Materials Irradiation Test (FMIT) facility. Wire-type specimens have been used to obtain tensile data for several metals irradiated at RTNS-II. Difficulties in the control of wire specimen dimensions led to the design of a miniature tensile specimen which could be fabricated from 0.25 mm thick sheet stock. Sheet-type tensile specimens are currently our standard tensile specimen for high energy neutron source experiments. These specimens are fabricated, like transmission electron microscopy (TEM) disks, by a punching technique. Precise test frame alignment is essential if reproducible test data are to be obtained. The dedicated test frame developed for miniature tensile specimen testing is briefly described. Miniature tensile specimens of a range of metals have been fabricated and tested. The data are reproducible and are in good agreement with data obtained from larger specimens. DOE

N84-15255# Hanford Engineering Development Lab., Richland, Wash.
USE OF THE DISK BEND TEST TO ASSESS IRRADIATION

PERFORMANCE OF STRUCTURAL ALLOYS
M. L. Hamilton and F. H. Huang Sep. 1983 15 p refs Presented at the Symp. on the Use of Nonstandard Subsized Specimens for Irradiated Testing, Albuquerque, N. Mex., 23 Sep. 1983
(Contract DE-AC06-76FF-02170)
(DE84-001484; HEDL-SA-2909-FP; CONF-8309170-1) Avail: NTIS HC A02/MF A01

The disk bend test has been a valuable technique for rapid evaluation of the ductility of a large number of alloys under consideration for use as structural materials in both the breeder and fusion reactor programs. The test employs the 3 mm diameter, 0.3 mm thick microscopy and density disk specimen, conserving valuable experimental volume in the limited reactor space available. The test involves bending the disk symmetrically about the center, producing a simple, axisymmetric stress state. Experimental results are in agreement with a theoretical analysis of the bend configuration. Both the advantages and the limitations of the technique are discussed. The test has shown that both commercial precipitation-strengthened alloys and the Path B alloys of the US Fusion Program exhibit unacceptably low ductilities following irradiation. This was demonstrated for a number of alloys, in a variety of thermomechanical conditions, including cold worked, cold worked and aged, and solution treated and aged. DOE

N84-15256# Oak Ridge Y-12 Plant, Tenn. Metals and Ceramics Dept.
ION PLATING IN CORROSION PROTECTION
Gary W. Vest 8 Sep. 1983 35 p Presented at the ASM Met. Technol. of Uranium and Uranium Alloys Seminar, Gatlinsburg, Tenn., 26-28 May 1981 Submitted for publication
(Contract W-7405-eng-26)
(DE84-001182; Y/DV-205; CONF-8105139-14) Avail: NTIS HC A03/MF A01

The ion plating process and the associated advantages and disadvantages of this coating method are described. The specific example of ion plating aluminum onto the uranium-0.8 weight percent titanium alloy is covered in detail. The corrosion properties of the plated alloy are related back to the process variables, and the coating layer and interface region are characterized. DOE

N84-15257# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EFFECTS OF PULSED DUAL-ION IRRADIATION ON PHASE TRANSFORMATIONS AND MICROSTRUCTURE IN TI-MODIFIED AUSTENITIC ALLOY
E. H. Lee, N. H. Packan, and L. K. Mansur 5 Jan. 1983 28 p refs Presented at the TMS/AIME Fall Meeting on Radiation Damage Anal. for Fusion Reactors, St. Louis, 24 Oct. 1982
(Contract W-7405-eng-26)
(DE84-001985; CONF-821049-25) Avail: NTIS HC A03/MF A01

The influence of pulsed 4 MeV Ni ion bombardment, with and without simultaneous helium injection, was explored in a low swelling, Ti-modified austenitic stainless steel. Irradiations were carried out to 70 dpa at 9500K; the pulsing frequencies were either 60 s on/off or 1 s on/off. Compared to continuous irradiation, pulsing caused a decrease in the interstitial loop diameter at 1 dpa, although at higher doses the overall dislocation density was not affected. Pulsing and helium both promoted the stability of precipitates and retarded the subsequent G phase formation; in some cases G-phase was suppressed and eta phase formed instead. Small bubble-like cavities were observed to grow into large voids after steady dual beam irradiation to 70 dpa. However, this conversion was suppressed by pulse irradiation to 70 dpa and furthermore the sizes of the small cavities were somewhat reduced. The results are explained in terms of current mechanistic understanding of mean point defect kinetics and the evolution of microstructure and microcomposition during irradiation with superimposed annealing periods. DOE

N84-15258# Sandia Labs., Albuquerque, N. Mex.
PIT INITIATION RESISTANCE OF FERRITIC STAINLESS STEELS IN CHLORIDE ENVIRONMENTS FROM 800 TO 2600C
W. R. Cieslak and D. J. Duquette (Rensselaer Polytechnic Inst.) 1983 17 p refs Presented at the Conf. on Environ. Degradation of Mater. in Nucl. Power Systems-Water Reactors, Myrtle Beach, S. C., 22 Aug. 1983
(Contract DE-AC04-76DP-00789)
(DE84-000355; SAND-83-1714C; CONF-830845-5) Avail: NTIS HC A02/MF A01

The pitting resistance of high-purity ferritic stainless steels has been studied by potentiodynamic anodic polarization, mechanical film-rupture (stratch) testing, and microstructual examination The purpose has been to determine the ability of the Fe-Cr-Mo alloys to resist pit initiation at temperatures up to 2600 C in chloride environments. At temperatures exceeding about 2000 C, Cr is shown to become much more effective than Mo to enhance alloy pitting resistance. In fact, at 2600 C, 2% Mo does not noticeably affect the pitting resistance of 18% Cr or 28% Cr steels. Also, 5% Mo is more effective for the lower Cr than for the higher Cr alloy, unlike lower temperatures, at which the effect of the two elements is greater than additive. Preferential localized attack at microstructural features, e.g. inclusions, is not observed under any of the experimental conditions, rather the pit-initiation resistance is controlled solely by alloy composition. DOE

N84-15259# California Univ., Livermore. Lawrence Livermore Lab.
YIELD STRESS OF TYPE 21-6-9 STAINLESS STEEL OVER A WIDE RANGE OF STRAIN RATE (10(-5) TO 10-4 s(-1)) AND TEMPERATURE
M. E. Kassner and R. D. Breithaupt Jul. 1983 7 p refs
(Contract W-7405-eng-48)
(DE83-017159; UCID-19818) Avail: NTIS HC A02/MF A01

The effects of high strain rate 10(2) to 10(4) s(+1) on the yield strength of 21-6-9 austenitic stainless steel are discussed. The reported yield stresses are appropriate to the temperature range from ambient to 7500 C. The high strain rate stresses were determined from Hopkinson split bar tests. The high strain rate data are compared to the strength of 21-6-9 of identical structure and composition at lower rates (e.g., 10(+4) s(+1). Such comparison provides insight into the rate dependence, at various temperatures to 7500 C, of plastic flow over a wide range (eight orders of magnitude) of strain rate. DOE

N84-15260 Houston Univ., Tex.
EFFECTS OF HYDROGEN ON STRENGTH AND DUCTILITY OF TANTALUM Ph.D. Thesis
Farouk Gad Attia 1983 173 p
Avail: Univ. Microfilms Order No. DA8317393

The effects of dissolved hydrogen on the strength and ductility of polycrystalline and single crystal tantalum have been studied in the temperature range between 78K and 373K. Tensile tests were performed at two strain rates of 1.7 x 0.001/sec and 0.85 x 0.1/sec on hydrogen-free specimens as well as specimens containing 30 to 170 ppm wt. H. The fracture surfaces of all tested specimens were also examined using scanning electron microscope. The studies were undertaken with the ultimate goal of determining the roles of hydrogen concentration, grain boundaries, tensile strain rate, and temperature in the processes of strengthening, embrittlement, and fracture of tantalum as a representative of Group VA metals. The yield stress results show that addition of 30 to 160 ppm wt. H to polycrystalline Ta results in alloy softening which is reversed to a strengthening effect at lower temperatures. Increasing the strain rate results in reduced softening and increased strengthening. Both the softening and strengthening effects are found to increase as the amount of dissolved hydrogen is increased. Dissert. Abstr.

N84-15191# Council for Scientific and Industrial Research, Pretoria (South Africa).
CORROSION RESEARCH
In its Activities of the National Chemical Research Lab. 1982 p 29-50 (For primary document see N84-15188 06-23)
Avail: NTIS HC A07/MF A01

N84-15310# Chamber of Mines, Johannesburg (South Africa). International Gold Corp.

THE UNIQUE SURFACE PROPERTIES OF GOLD
G. Gafner *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 99-105 (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15311# South African Copper Development Association (Pty) Ltd., Marshalltown.
SURFACE COATING SYSTEMS FOR COPPER AND COPPER ALLOYS
I. Ogilvie *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 107-112 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15315# Pretoria Univ. (South Africa). Dept. of Physics.
DEPTH RESOLUTION DUE TO INSTRUMENTAL FACTORS IN SPUTTER-ASSISTED DEPTH PROFILING
J. B. Malherbe *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 147-152 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15317# Bonn Univ. (West Germany). Div. of Nuclear Chemistry.
KINEMATICS OF THE STRUCTURE AND MORPHOLOGY DURING SURFACE REACTIONS BETWEEN TRANSITION METALS AND MOLECULAR HYDROGEN
L. C. vonErichsen, H. Meusemann, H. Haverkamp, F. Luckner, A. Maas, S. M. Hosseini (Kabul Univ.), and H. Urbahn (Gesellschaft fuer Reaktoricherheit) *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 169-175 refs Sponsored in part by the Deutsche Forschungsgemeinschaft (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15318# National Physical Research Lab., Pretoria (South Africa).
USE OF SCANNING ELECTRON MICROSCOPY IN STUDYING SURFACE REACTIONS OF METALS WITH HYDROGEN
C. M. Stander *In its* Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 177-183 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15320# Perkin-Elmer and Co. G.m.b.H., Munich (West Germany). Physical Electronics Div.
GRAIN BOUNDARY SEGREGATION AND CAVITY FORMATION IN CREEP EMBRITTLED Cr-Mo STEELS
H. Goretzki, U. Franzoni, and S. Sturlese (Centro Sperimentale Metallurgico) *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 195-201 refs Sponsored in part by the European Coal and Steel Community (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15321# Pretoria Univ. (South Africa). Dept. of Materials Science and Metallurgical Engineering.
EVALUATION OF THE PITTING CORROSION RESISTANCE OF A Fe-12% Cr ALLOY
R. F. Sandenbergh *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 205-210 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15322# National Inst. for Metallurgy, Randburg (South Africa).
THE DESCALING OF 3Cr12 STEEL
R. L. Paul and P. E. L. Balestra *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 213-217 (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15323# National Inst. for Metallurgy, Randburg (South Africa).
SURFACE CHEMISTRY IN THE FLOTATION OF MINERALS
P. J. Harris *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 221-226 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-16025*# Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
ANALYTICAL AND NUMERICAL SOLUTION FOR A SOLIDIFYING LIQUID ALLOY SLAB
Basil N. Antar *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 13 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11F

N84-16036*# Auburn Univ., Ala. Dept. of Physics.
ATOMIC OXYGEN EFFECTS ON MATERIALS
Albert T. Fromhold *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 31 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11F

N84-16050*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
DETERMINATION OF SYSTEMS SUITABLE FOR STUDY AS MONOTECTIC BINARY METALLIC ALLOY SOLIDIFICATION MODELS
James E. Smith, Jr. *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 24 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N84-15261 California Univ., Los Angeles.
THE PREPARATION AND PROPERTIES OF POROUS GLASS-POLYMER COMPOSITE Ph.D. Thesis
Chin Chuan Liu 1980 208 p
Avail: Univ. Microfilms Order No. DA8321937

A new type of transparent glass polymer composite, with the glass as the matrix phase and the polymer as the second phase was developed. The Corning porous glass and polymethyl methacrylate (PMMA) were chosen as the matrix and the second phase respectively. Glass plastic composites were in existence for years, but in most of them glass is the second phase dispersed in a plastic matrix. In contrast to this traditional type of glass plastic composite, a new type of composite, in which the plastic phase was impregnated into a porous body such as cement, concrete or ceramics was extensively studied since the 1960's. The physical and mechanical properties of these new composites were improved significantly in comparison with the original phases. Dissert. Abstr.

N84-15262 Lowell Univ., Mass.
SYNTHESIS AND CHARACTERIZATION OF SOME THERMOTROPIC NEMATIC AND CHOLESTERIC POLYMERS Ph.D. Thesis
Shripathy Vilasagar 1983 108 p
Avail: Univ. Microfilms Order No. DA8321401

Several polymers which incorporate the mesogenic moieties in the side chains as well as in the main chain were synthesized and characterized. Copolymers of cholesteryl methacrylate (ChMA)/p-cyanobenzylidene-p-aminostyrene (CBAS) and cholesteryl acrylate (CHA)/N (p-acryloyloxy benzylidene)-p-aminobenzonitrile (ABABN) gave choleseric or smetic glasses with poorly developed mesophases and no well defined transition. 4,4 prime-Azoxphenol (bisphenol 8) and 2.2 prime-dimethyl 4,4' azoxyphenol (bisphenol 9) were condensed with dodecanedoic acid (DDA) and/or 3-methyladipic acid (MAA), both racemic and chiral, to give soluble polyesters with well defined transitions and well

characterized nematic and cholesteric mesophases. Miscibility studies were also performed. Dissert. Abstr.

N84-15263 Rensselaer Polytechnic Inst., Troy, N. Y.
HEAT CAPACITY AND THERMODYNAMIC PROPERTIES OF LINEAR MACROMOLECULES Ph.D. Thesis
Suk-Fai Lau 1983 198 p
Avail: Univ. Microfilms Order No. DA8321202

Computer programs are developed to calculate 1, 2 and 3 dimensional Debye functions. Strategies are also derived to calculate Debye and Tarasov temperatures by inversion from heat capacities and for subsequent calculation of Cv from theta temperatures and frequency spectra. Both, 3 dimensional Debye and Tarasov analyses are carried out on 35 linear macromolecules. Experimental heat capacities from the literature for these and 63 other polymers were collected in the ATHAS data bank. The skeletal heat capacity of linear macromolecules is often best represented by only two vibrations per chain atom. and for most of the all-carbon chain macromolecules the intramolecular skeletal heat capacity is only molecular weight dependent. A complete analysis including measurement and calculation is carried out on PTFE. A set of recommended heat capacities is obtained by critically evaluating literature data and measured data from this work (220 to 700 K). Author

N84-15264 Illinois Univ., Urbana-Champaign.
POLYMER CHARACTERIZATION BY ELECTROHYDRODYNAMIC IONIZATION MASS SPECTROMETRY: PROBING COMPOSITION AND CHEMISTRY OF MIXTURES IN SOLUTION Ph.D. Thesis
Kelvin Wing Shui Chan 1983 165 p
Avail: Univ. Microfilms Order No. DA8324527

The complexation chemistry of poly(ethylene glycols) (PEG's) with alkali metal ions in glycerol solution was studied by Electrohydrodynamic Ionization Mass Spectrometry (EHMS). To ascertain that EHMS spectra qualitatively and quantitatively reflect solution composition, several fundamentals of EHMS were characterized. Fragmentation is not likely to occur in EHMS; spectra qualitatively reflect ions sampled from solution. This was confirmed by the detection of the parent molecular ions of diquaternary ammonium salts. It was found that less fragmentation occurred in EHMS when compared to other 'soft' mass spectrometric techniques. Chemical reactions in the matrix can complicate EHMS spectra. Ethylenediaminetetraacetic acid was found to form esters with glycerol in the presence of acid catalysis (iron(III) or sulfuric acid). The solvent and the supporting electrolyte were also observed to participate in ligand exchange reactions with labile zinc(II) and chromium(II) trisbipyridine complexes. Dissert. Abstr.

N84-15265# Royal Aircraft Establishment, Farnborough (England).
RELATIONSHIP BETWEEN THE GLASS TRANSITION TEMPERATURE AND THE CHEMICAL STRUCTURE OF POLYMERS
R. Becker 1982 59 p refs Transl. into ENGLISH from Faserforschung und Textiltech. (West Germany), v. 29, no. 6, 1978 p 361-385
(RAE-Lib-Trans-2098) Avail: NTIS HC A04/MF A01

Predominantly from an empirical point of view a survey is provided on the semi-quantitative and quantitative relationships between glass temperature and chemical structure of polymers and between the relationships of the basic parameters affecting the glass temperature. The calculation of T sub g by the structure-related increment method based on the principle of additivity of the properties of constituting elements is discussed in detail. Author

N84-15266# Department of Energy, Washington, D. C. Div. of Materials Sciences.
ENERGY MATERIALS COORDINATING COMMITTEE (EMACC). CONTRACTORS MEETING ON PROBLEMS AND OPPORTUNITIES IN STRUCTURAL CERAMICS
Apr. 1983 289 p Meeting held in Germantown, Md., 29-30 Sep. 1982
(CONF-8209111) Avail: NTIS HC A10/MF A01

Combustion zone durability energy conversion and utilizations technologies materials, fossil energy structural ceramics, ceramics in the vehicle propulsion technology development program and a preview of a heat engine ceramic technology program, basic materials sciences structural ceramics research, an overview of DOD programs on structural ceramics, ceramics components for vehiclar gas turbines. Japanese structural ceramics research, high temperature materials laboratory and ceramic specimen preparation, and market potential for structural ceramics are discussed. Author

N84-15267*# Alabama Univ., Huntsville.
NEW POLYMERS FOR LOW-GRAVITY PURIFICATION OF CELLS BY PHASE PARTITIONING Final Report, 1 Sep. 1980 - 30 Sep. 1983
J. Milton Harris 30 Sep. 1983 9 p refs
(Contract NAS8-33978)
(NASA-CR-170957; NAS 1.26:170957) Avail: NTIS HC A02/MF A01 CSCL 11G

A potentially powerful technique for separating different biological cell types is based on the partitioning of these cells between the immiscible aqueous phases formed by solution of certain polymers in water. This process is gravity-limited because cells sediment rather than associate with the phase most favored on the basis of cell-phase interactions. In the present contract we have been involved in the synthesis of new polymers both to aid in understanding the partitioning process and to improve the quality of separations. The prime driving force behind the design of these polymers is to produce materials which will aid in space experiments to separate important cell types and to study the partitioning process in the absence of gravity (i.e., in an equilibrium state). B.W.

N84-15268*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Adhesion Science.
NONLINEAR VISCOELASTIC CHARACTERIZATION OF STRUCTURAL ADHESIVES
M. A. Rochefort and Hal F. Brinson Dec. 1983 133 p refs Sponsored in part by the Army
(Contract NAG1-227)
(NASA-CR-172279; NAS 1.26:172279) Avail: NTIS HC A07/MF A01 CSCL 11A

Measurements of the nonliner viscoelastic behavior of two adhesives, FM-73 and FM-300, are presented and discussed. Analytical methods to quantify the measurements are given and fitted into a framework of an accelerated testing and analysis procedure. The single integral model used is shown to function well and is analogous to a time-temperature stress-superposition procedure (TTSSP). Advantages and disadvantages of the creep power law method used in this study are given. Author

N84-15269*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF AN IMPROVED PROTECTIVE COVER/LIGHT BLOCK FOR MULTILAYER INSULATION
L. M. Thompson, J. M. Stuckey, Don Wilkes, and Randy Humphries Oct. 1983 20 p
(NASA-TM-82563; NAS 1.15:82563) Avail: NTIS HC A02/MF A01 CSCL 11E

The feasibility of using a scrim-reinforced, single metallized, 4-mil Tedlar film as a replacement for the Teflon coated Beta-cloth/single metallized 3-mil Kapton film presently used as the protective cover/light block for multilayer insulation (MLI) on the Orbiter, Spacelab, and other space applications was demonstrated. The proposed Tedlar concept is lighter and potentially lower in cost. Thermal analysis with the proper concept was much simpler than with the present system. Tests have already demonstrated that white Tedlar has low alpha (adsorption) degradation in space from U.V. The proposed concept was 4400 percent cheaper with nominal weight savings of 50 percent. Author

N84-15270*# National Aeronautics and Space Administration, Washington, D. C.

SCREENING AND CLASSIFICATION OF CERAMIC POWDERS
Shigeo Miwa Aug. 1983 19 p Transl. into ENGLISH from Seramikkusu (Japan), v. 12, no. 5, 1977 p 391-397 Transl. by Scitran, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77092; NAS 1.15:77092) Avail: NTIS HC A02/MF A01 CSCL 11B

A summary is given of the classification technology of ceramic powders. Advantages and disadvantages of the wet and dry screening and classification methods are discussed. Improvements of wind force screening devices are described. Author

N84-15271*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HOT MELT RECHARGE SYSTEM Patent Application
Donald J. Progar, inventor (to NASA) Filed 26 Aug. 1983 11 p
(NASA-Case-LAR-12881-2; US-Patent-Appl-SN-526755) Avail: NTIS HC A02/MF A01 CSCL 11A

A package assembly is described for precisely positioning a charge of hot melt adhesive onto an attachment pad or a point of use. The adhesive is heated to softening or melt temperature (280 F - 325 F) and thereafter cooled to resolidifying temperature. A single sided pressure sensitive polyimide film tape serves with another film strip to protect the sandwiched adhesive strip until use and to hold the adhesive in precise position until thermally bonded to its point of use. Tab ends serve as aids in stripping tapes from the adhesive charge. NASA

N84-15272# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
AEROSTAT ICING PROBLEMS
Ben Hanamoto Aug. 1983 32 p
(Contract MIPR-FY71218200015)
(AD-A133403; CRREL-SR-83-23) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report describes laboratory tests to determine the effectiveness of a copolymer coating on a balloon to minimize ice build-up problems when operating in sleet, freezing rain or other ice-forming conditions. Methods for deicing the surface after an ice cover form are also described. A small-scale balloon was used for the laboratory tests. A full-scale prototype was also partially coated with the copolymer to test its effectiveness as an icing control measure. Author (GRA)

N84-15273# Army Construction Engineering Research Lab., Champaign, Ill.
PRELIMINARY INVESTIGATION OF CERAMIC-COATED ANODES FOR CATHODIC PROTECTION Final Report
E. G. Segan and A. Kumar Aug. 1983 20 p
(AD-A133440; AD-E750844; CERL-TR-M-333) Avail: NTIS HC A02/MF A01 CSCL 09/1

A cathodic protection anode was manufactured by plasma-spraying an electrically conducting lithium ferrite coating on button-shaped 99 percent pure titanium and niobium substrate. Lithium ferrite was selected because of its unique adherence to titanium and niobium substrates, as well as its good electrical conductivity, low dissolution rate, and long-range stability. The pitting behavior of the titanium substrate in chloride solutions was characterized; the worst case of pitting potential was 9.66 V. The dissolution rate of the lithium-ferrite-coated anode was measured over a 2-month period and was determined to be 1 to 2 g per ampere year in an aerated 3.5 percent sodium chloride solution. No damaging effects from the tests were observed on the coating. The button-shaped anode was designed so it could be installed easily on underground pipes or on structures in water, such as waterway lock gates and elevated water storage tanks, without dewatering the structure. The ceramic coating's low dissolution rate provides the advantage that the anode can be relatively small and still provide considerable protection from corrosion. A small anode can be installed and replaced relatively easily and is less vulnerable to damage. Author (GRA)

N84-15274# Hughes Aircraft Co., El Segundo, Calif. Technology Support Div.
CHEMISTRY, CHARACTERIZATION AND PROCESSING OF IMC CURING POLYMERS Final Report, Sep. 1979 - Jun. 1983
Kreisler S. Y. Lau Wright-Patterson AFB, Ohio AFWAL Jul. 1983 144 p
(Contract F33615-79-C-5101; AF Proj. 2419)
(AD-A133479; AFWAL-TR-83-4063) Avail: NTIS HC A07/MF A01 CSCL 07/3

A variety of methods for a low-cost synthesis of the IMC curable monomer, 2,2'-bis(phenyl-ethynyl)-4,4',5,5'-tetraaminobiphenyl, were explored without success. A low-cost route was found for the preparation of the IMC curable monomer, 2,2'-bis(phenylethynl)-5,5'-diaminobiphenyl. Numerous model compounds with potential IMC reactions were prepared and characterized by thermal analysis. Some high molecular weight isoimide polymers were synthesized for study of the thermal rearrangement of the isoimide group to an imide group as an IMC-type reaction. Author (GRA)

N84-15275# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
THE INFLUENCE OF SURFACE ROUGHNESS ON THE TRANSFER AND WEAR OF POLYMERS Final Report, 14 Apr. 1980 - 13 Aug. 1983
Norman S. Eiss, Jr. 30 Sep. 1983 17 p
(Grant DAAG29-77-G-0102)
(AD-A133527; ARO-16862.4-EG) Avail: NTIS HC A02/MF A01 CSCL 11/9

Wear mechanisms of polymer sliding systems were studied. The wear rates of rigid polyvinyl chloride and low density polyethylene pins sliding on ground steel disks decreased as the average asperity curvature and the depth of penetration of the asperities in the polymer decreased. Observation of the sliding of polycarbonate and polyvinly chloride disks against model asperities in the scanning electron microscope showed that elastic and plastic flow of the polymers around the asperities was much more evident than the formation of wear particles by fracture. A steel ball sliding on polycarbonate, polyvinyl chloride, polyethyleneterephthalate, and three polymides required 20 to 550 cycles of sliding before wear particles started to form. The fatigue wear of polymide films on steel substrates in a ball on polymide test was lowest for the polymide with the lowest t sub g, and lowest modulus. The wear of polytetrafluoroethylene was found to decrease as the molecular weight and crystallinity increased. The wear debris had lower molecular weight but slightly increased crystallinity. Author (GRA)

N84-15276# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
NEW POLYCONJUGATED OXIDATION-REDUCTION POLYMERS, AS WELL AS A METHOD AND APPARATUS FOR ELECTROCHEMICAL REGENERATION
Rene Buvet, Roger Vallor, Richard Messina, Jacques Gal, and Liang-Tse Yu 1983 18 p Transl. into ENGLISH of German Patent no. p. 2625443.3 (5 Jun. 1976)
(Contract DE-AC02-87CH-10093)
(DE84-002813; DOE-TR-258) Avail: NTIS HC A02/MF A01

The redox or electron exchange polymers are products of mild oxidation in an acid medium of aromatic amines, e.g., aniline or pyrrole. These polymers may also be condensation products of a quinone derivative. The half reduction potential of the polymers lies between 50 and 750 mV relative to the normal hydrogen electrode, and the redox capacity is between 0.5 and 5 m Eg/g. An apparatus for the electrochemical regeneration of these polymers is described, as are examples of the use of these polymers to conduct oxidation reduction reactions on various materials. DOE

N84-15277# North Carolina State Univ., Raleigh.
NORTH CAROLINA USED-MOTOR-OIL RE-REFINING PROGRAM: ECONOMICS AND LOGISTICS AND OPERATING RESULTS
J. R. Canada Jul. 1983 20 p refs Sponsored in part by state of North Carolina

(Contract DE-FG01-80CS-40338)
(DE84-001448; DOE/CS-40338/3; TR-3) Avail: NTIS HC A02/MF A01

A program to develop and demonstrate a State-operated re-refining system for used engine oil is discussed. The North Carolina Oil Re-Refining Facility, using a 2,000,000 gallon input per year PROP plant, was installed in late 1980. During the first year of startup operation ending December 31, 1981, approximately 137,000 gallons were produced. Operating and financial results for 1982 and the first five months of 1983 are discussed. During the 17 months ending May 1983 only about 270,000 gallons were produced and sold. Based on normal annual accounting the loss for that period was $685,060 and the cashflow loss was $480,679. Even after substantial upgrading modifications were done in 1982-83, the plant still has major throughput problems, the greatest of which is the required quality and quantity of used oil feedstock. Financial results, cost-variance analyses, production impediments encountered, and also future operating volumes necessary for the facility to cover costs are discussed. DOE

N84-15278# California Inst. of Tech., Pasadena.
EXAFS STUDIES OF THE METALLIC GLASS La80Ga20
David V. Baxter, Art Williams, and William L. Johnson Jul. 1983 12 p refs
(Contracts DE-AT03-81ER-10870; DE-AM03-76SF-00767)
(DE84-002022; DOE/ER-10870/142) Avail: NTIS HC A02/MF A01

Ga-edge EXAFS experiments have been performed on the metallic glass La80Ga20. The results obtained are able to discriminate between a number of different models for the pair distribution function of atoms around the Ga, and the model which best fits the data provides coordination numbers and distances which are in agreement with earlier diffraction experiments. We find, however, that the two techniques give significantly different results for the degree of topological disorder in the first La coordination shell about the Ga atoms. DOE

N84-15279# Ames Lab., Iowa.
ELECTRICAL CONDUCTIVITIES OF POLYCRYSTALLINE AND SINGLE-CRYSTAL Er2O3-STABILIZED HAFNIA
G. W. Jordan and M. F. Berard 1983 21 p Presented at the 85th Ann. meeting of the American Ceramic Society, Chicago, 25 Apr. 1983
(Contract W-7405-eng-82)
(DE83-017681; IS-M-429; CONF-830451-24) Avail: NTIS HC A02/MF A01

Erbia-stabilized hafnia is an electrolytic conductor. The bulk electrical conductivities determined from complex impedance analysis of data for polycrystalline specimens is the same as that measured for single crystals, and they are independent of P sub O2 below 1 atm and 10700 C. The effects of surface finish, aspect ratio, and porosity of the (high sintered density) specimens is negligible. The electrical conductivity generally decreases and the activation energy for ionic conduction generally increases as the dopant level increases, although plateaus are observed over the composition range 20 to 35 mol% Er2O3. DOE

N84-15280# Sandia Labs., Albuquerque, N. Mex.
VOLUME RECOVERY IN GLASSES: A FREE-VOLUME DIFFUSION PROCESS
John G. Curro, Robert E. Robertson (Ford Motor Co., Dearborn, Mich.), and Robert Simha (Case Western Reserve Univ., Cleveland) 1983 6 p refs Presented at a Symp. on Phys. Aging Processes in Molecular and Atomic Glasses, Williamsburg, Va., 25 Sep. 1983
(Contract DE-AC04-76DP-00789)
(DE83-013771; SAND-83-1278C; CONF-8309100-1) Avail: NTIS HC A02/MF A01

The densification which occurs in glasses during isothermal annealing can be viewed as collapse of free volume. Recently, two theories have been developed for volume-recovery behavior in glasses which make use of this connection with free volume. Basically, both theories view the free-volume change as being due to a diffusion mechanism where the diffusion constant (or transition rate) is related to the free volume through the Doolittle equation. The Curro, Lagasse, Simha treatment leads to a nonlinear diffusion equation for the free-volume fraction. The Robertson theory, on the other hand, is a stochastic model in which transitions occur between discrete states. Both models agree qualitatively with experimental, dialtometric data on glassy polymers. In particular, nonlinear and memory effects are observed. In addition, these models predict that the value of the Williams-Watts parameter (ALPHA) is approximately 0.6. DOE

N84-15281# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
THE INFLUENCE OF THE ENVIRONMENT ON THE MECHANICAL CHARACTERISTICS OF COMPOSITE MATERIALS: DESIGN CONSIDERATIONS [INFLUENCIA DEL MEDIO AMBIENTE SOBRE LAS CARACTERISTICAS MECANICAS DE LOS MATERIALES COMPUESTOS. CONSIDERACIONES DE DISENO]
Jose Pintado Sanjaunbenito 19 Jul. 1983 76 p refs In SPANISH
(INTA-INFORME-I-1/221/720/83047) Avail: NTIS HC A05/MF A01

The effects of temperature and humidity on the mechanical behavior of composite materials are discussed. The absorption of humidity by a polymeric matrix is reviewed. Other environmental factors, such as radiation and time, and their effects are also examined. Since no general theoretical models exist, the design is based on carefully planned tests. Design strategy is analyzed and related to environmental factors. Author (ESA)

N84-15282 Rutgers - The State Univ., New Brunswick, N. J.
CRAZING AND FATIGUE BEHAVIOUR OF ONE AND TWO PHASE POLYMERS Ph.D. Thesis
Chao-Chin Chen 1983 281 p
Avail: Univ. Microfilms Order No. DA8320451

The deformation modes and the fracture behavior of two glassy polymers, PS and SAN, and two rubber modified polymers, HIPS and ABS, subject t⁻ monotonic tensile loading and to alternating tension-compression loading, were determined. A light reflecting method was used to detect craze initiation in both tensile and fatigue tests carried out on specimens of transparent PS and SAN. For non-transparent materials, such as HIPS and ABS, a hysteresis loop measurement method was utilized in the fatigue tests to detect shear-induced strain softening and also the onset of crazing. Quantitative results concerning the relative importance of the fatigue-induced craze initiation phase and the crack propagation phase are given for both unmodified polymers and for the rubber modified polymers. Attention is also given to the effect on fatigue performance of external variables such as stress amplitude, mean stress and frequency. Dissert. Abstr.

N84-15313# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Physics.
A FORMULA FOR THE SPUTTERING YIELD OF POLYCRYSTALLINE MATERIALS
G. N. vanWyk and A. H. Lategan *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 131-135 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15314# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Grenzflaechenforschung und Vakuumphysik.
QUANTITATIVE SPUTTER PROFILING AT SURFACES AND INTERFACES
J. Kirschner and H. W. Etzkorn *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 137-144 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-16030*# Alabama A & M Univ., Huntsville. Dept. of Chemistry.
PARTIAL ANALYSIS OF INSTA-FOAM
Libby W. Chou *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 30 p refs (For

primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11G

N84-16033*# Tennessee Technological Univ., Cookeville. Dept. of Chemistry.
SYNTHESIS OF N-SUBSTITUTED SILANEAMINES: MONOMERIC PRECURSORS OF SILICON CARBIDE-NITRIDE FIBERS
David J. Crouse *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 21 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11G

N84-16037*# Mississippi State Univ., State College. Dept. of Chemical Engineering.
AN EVALUATION OF TECHROLL SEAL FLEXIBLE JOINT MATERIAL
William B. Hall *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 18 p (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11A

N84-16042*# Tuskegee Inst., Ala. Dept. of Chemistry.
ULTRAHIGH MOLECULAR WEIGHT AROMATIC SILOXANE POLYMERS
Larry M. Ludwick *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 13 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11G

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N84-15283*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
BROAD SPECIFICATION FUELS COMBUSTION TECHNOLOGY PROGRAM Final Report, Sep. 1979 - Feb. 1982
W. J. Dodds and E. E. Ekstedt Jan. 1984 341 p refs
(Contract NAS3-22063)
(NASA-CR-168179; NAS 1.26:168179) Avail: NTIS HC A15/MF A01 CSCL 21D

Design and development efforts to evolve promising aircraft gas turbine combustor configurations for burning broadened-properties fuels were discussed. Design and experimental evaluations of three different combustor concepts in sector combustor rig tests was conducted. The combustor concepts were a state of the art single-annular combustor, a staged double-annular combustor, and a short single-annular combustor with variable geometry to control primary zone stoichiometry. A total of 25 different configurations of the three combustor concepts were evaluated. Testing was conducted over the full range of CF6-80A engine combustor inlet conditions, using four fuels containing between 12% and 14% hydrogen by weight. Good progress was made toward meeting specific program emissions and performance goals with each of the three combustor concepts. The effects of reduced fuel hydrogen content, including increased flame radiation, liner metal temperature, smoke, and NOx emissions were documented. The most significant effect on the baseline combustor was a projected 33% life reduction, for a reduction from 14% to 13% fuel hydrogen content, due to increased liner temperatures. Author

N84-15284*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
ATOMIZATION AND MIXING STUDY Interim Report
Allan Ferrenberg and Vance Jaqua 27 Jul. 1983 190 p refs
(Contract NAS8-34504)
(NASA-CR-170943; NAS 1.26:170943; RI/RD83-170) Avail: NTIS HC A09/MF A01 CSCL 21I

This report contains the results of literature surveys and studies of the atomization and mixing characteristics of liquid rocket injectors (especially triplets, pentads, and coaxial injectors that may be applicable to LOX/hydrocarbon propellants), the correlating parameters and other means by which such data is organized and reported, and the methods by which this data is obtained. Also, the results of the propellant mixing tests performed under this contract are reported herein. B.W.

N84-15285# Ballistic Research Labs., Aberdeen Proving Ground, Md.
CATALYSIS OF NITRAMINE PROPELLANTS BY MMTAL BOROHYDRIDES Final Report
Robert A. Fifer and William F. McBratney Jul. 1983 31 p
(DA Proj. 1L1-61102-AH-43)
(AD-A133215; AD-F300311; ARBRL-MR-03300) Avail: NTIS HC A03/MF A01 CSCL 19/1

Burning rates were measured over the pressure range 10 to 280 Mpa for an inert binder HMX-based nitramine propellant with and without added sodium borohydride (NaBH4). The addition of 6.4% NaBH4 resulted in more than a two-fold increase in burning rate over the pressure range 30-300 MPa. 9 GRA

N84-15286# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
DEVELOPMENT OF QUANTITATIVE INFRARED ANALYSIS FOR MONITORING WATER AND EMULSIFYING AGENTS IN FIRE-RESISTANT MICROEMULSION DIESEL FUELS Final Report
Shing-Bong Chen Apr. 1983 18 p
(AD-A133242; MERADCOM-2381) Avail: NTIS HC A02/MF A01 CSCL 21/4

The Army has developed a Fire-Resistant Fuel (FRF) which consists of 10 volume percent (vol %) water, 6 volume percent amide/amine/soap emulsifying agent (EA) and 84 volume percent Diesel Fuel (DF-2). It is necessary to have methods of monitoring the volume percent of each component in the blending of FRF from FRF field mixer unit. A quantitative infrared (IR) analysis for monitoring water and EA in FRF has been developed. The differential IR technique was applied to minimize the interference of weak DF-2 absorption in the regions of analytical wave number chosen. The IR method would determine volume percent of water in the range of 4 to 10 volume percent and volume percent of EA in the range of 4 to 8 volume percent of FRF with fair accuracy. Author (GRA)

N84-15287# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
PROPELLANT NONLINEAR CONSTITUTIVE THEORY EXTENSION: PRELIMINARY RESULTS Special Technical Report, Sep. 1980 - Sep. 1982
E. C. Francis, D. G. Lemini, C. Carlton, W. L. Huffered, and M. Gurtin Aug. 1983 338 p
(Contract F04611-80-C-0052; AF Proj. 2307)
(AD-A133364; UTC/CSD-2742; AFRPL-TR-83-034) Avail: NTIS HC A15/MF A01 CSCL 21/9

This report details the technical effort put forth by CSD and its subcontractors during the first three phases of this program for propellant nonlinear constitutive theory extension. This includes the Phase I preliminary study in which the Quinlah theory was critiqued, alternate approaches were studied and detailed research planning accomplished. Also included are the detailed experimental evaluations of propellant during Phases II and III, the uniaxial/isothermal investigation and the two-dimensional variable temperature investigation. Detailed subcontractor theoretical development and predictions are presented. GRA

N84-15288# Coordinating Research Council, Inc., Atlanta, Ga.
1981 CRC OCTANE NUMBER REQUIREMENT SURVEY
Jul. 1983 270 p
(AD-A133369; CRC-533) Avail: NTIS HC A12/MF A01 CSCL 21/4

In the 36th annual statistical survey of current model vehicles

conducted by the Coordinating Research Council, Inc., test data were obtained on 434 1982 model vehicles, including nine select models of special interest. Maximum octane number requirements were determined by testing under part-throttle conditions, as well as at maximum-throttle. Included also in the E-15-82 technique are the octane number requirements as determined by the 50th percentile driving profiles derived from past chase-car studies. This method, referred herein as the 50th percentile acceleration technique, is designed to more nearly represent customer-type driving. Surface ignition and rumble, if present, were also reported. Passenger cars and light-duty trucks including non-commercial vans (1/2-3/4 ton without four-wheel drive) were tested according to a weighted distribution. GRA

N84-15289# Coordinating Research Council, Inc., Atlanta, Ga.
1981 CRC (COORDINATING RESEARCH COUNCIL) DIESEL FUEL LOW-TEMPERATURE OPERABILITY FIELD TEST
Sep. 1983 226 p
(Contract DAAK70-81-C-0128)
(AD-A133543; CRC-528) Avail: NTIS HC A11/MF A01 CSCL 21/4

A cooperative experimental program including seven diesel-powered vehicles and eight specially prepared fuels was run at low ambient temperatures to define the low-temperature operability limit for each vehicle-fuel combination. The vehicle fleet consisted of four passenger cars and three heavy-duty trucks. The fuel set included three base fuels of differing cloud points and five additive-treated versions of these base fuels. The vehicle program was run in Kapuskasing, Ontario, Canada, during January to April 1981. Participants of the Coordinating Research Council developed the program plan, provided the special fuels, arranged for the loan of vehicles and instrumentation, volunteered technical support during the running of the program, and prepared the analysis report. Laboratory tests considered for correlative purposes included the Low Temperature Flow Test (LTFT), Cold Filter Plugging Point (CFPP), Cloud Point (CP), Pour Point (PP), and combinations of CP and PP. Of the laboratory tests examined, LTFT appeared to offer the most promise, although none of the laboratory tests appeared to be completely satisfactory in their present form. Author (GRA)

N84-15290# Los Alamos Scientific Lab., N. Mex.
EQUATION OF STATE FOR THE DETONATION PRODUCTS OF SEVERAL SIMPLE EXPLOSIVES
M. S. Shaw, B. L. Holian, and J. D. Johnson 1983 14 p refs Presented at Los Alamos/CEA High Explosives and Detonation Phys. Conf., Paris, 3 Oct. 1983
(Contract W-7405-eng-36)
(DE83-017266; LA-UR-83-2540; CONF-8310148-9) Avail: NTIS HC A02/MF A01

Effective spherical potentials for N2O2, NO, CO, and CO2 are obtained by fitting to various experimental and calculated quantities. An equation of state for mixtures of these molecules is determined by using ideal mixing and the hard-sphere perturbation theory of Ross. Calculations are then compared with Hugoniot data for N2 + O2 mixtures and overdriven NO detonations with excellent agreement. Also, the detonation velocities of O3/O2 mixtures, NO, TNM, and HNB were calculated and were found to be in very good agreement with experiment. DOE

N84-15291# Pritchard (C. Lewis), Crossville, Tenn.
GASOGEN FOR AUTOMOBILE USE Final Report
C. Lewis Pritchard 17 Jun. 1983 19 p
(Grant DE-FG44-81R4-10406)
(DE84-000712; DOE/R4-10406/T1) Avail: NTIS HC A02/MF A01

How wood scrap may be recycled as a gasoline substitute for use with an automobile is considered. A set of blueprints was obtained for the basic gaseogen design. It was proposed that the unit be mounted on a small trailer which would be pulled by the vehicle using the woodgas. A large circular saw driven by PTO from a rear wheel of the vehicle was envisioned for processing sawmill slabs into small pieces suitable for use in the woodgas generator. A makeshift solar kiln for wood drying was also proposed. Records of all expenditures involved were to be kept for the purpose of determining the economic viability of such a project. Activities necessary for implementing these plans may be divided into four general categories. Details taken from field notes are given which relate to: (1) purchase of materials; (2) construction of gasogen and saw; (3) transport, processing and storage of wood scrap; and (4) record keeping and correlation. DOE

N84-15292# Los Alamos Scientific Lab., N. Mex.
LARC: COMPUTER CODES FOR LAGRANGIAN ANALYSIS OF STRESS-GUAGE DATA TO OBTAIN DECOMPOSITION RATES THROUGH CORRELATION TO THERMODYNAMIC VARIABLES
Allan B. Anderson and Jerry Wackerle Jul. 1983 118 p refs
(Contract W-7405-eng-36)
(DE84-002404; LA-9651-MS) Avail: NTIS HC A06/MF A01

A package of five computer codes for analyzing stress-gauge data from shock-wave experiments on reactive materials is described. The data are analyzed to obtain rate laws from experiments. A Lagrangian analysis of the stress records, performed by program LANAL, provides flow histories of particle velocity, density, and energy. Three postprocessing programs, LOOKIT, LOOK1, and LOOK2, are included in the package of codes for producing graphical output of the results of LANAL. Program RATE uses the flow histories in conjunction with an equation of state to calculate reaction-rate histories. RATE can be programmed to examine correlations between the rate histories and thermodynamic variables. Observed correlations can be incorporated into an appropriately parameterized rate law. Program RATE determines the values of these parameters that best reproduce the observed rate histories. The procedure is illustrated with a sample problem. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N84-15293# Council for Scientific and Industrial Research, Pretoria (South Africa).
ADVANTAGES OF USING DIAMOND TOOLS BRAZED UNDER HIGH VACUUM
G. Kuebler-Tesch 1983 6 p Transl. into ENGLISH from Industrie Diamanten Rundschau (West Germany), v. 15, no. 2, 1981 p 117-118
(CSIR-Trans-1709) Avail: NTIS HC A02/MF A01

Diamond tools brazed under high vacuum are shown to assume greater importance since only a direct bond between the diamond and the holder can ensure that the cutting edge geometry and the running accuracy conform to the more stringent requirements of modern technology. N.W.

N84-15294# Council for Scientific and Industrial Research, Pretoria (South Africa).
NEW PROFILABLE BOND SYSTEM FOR DIAMOND AND CBN GRINDING WHEELS
R. Macina 1983 8 p Transl. into ENGLISH from Ind. Diamanten Rundschau (West Germany), v. 15, no. 2, 1981 p 101-103
(CSIR-Trans-1707) Avail: NTIS HC A02/MF A01

Attempts to use diamond or CBN grinding wheels for full cut or deep cutting processes in the machining of hard materials, were initially limited to grinding wheels coated by electrodeposition. The tool body was provided with the required profile and the diamond or CBN coating was electrodeposited in accordance with known methods. Success could be achieved with these grinding wheels in certain cases. The greater projection of abrasive grit obtained with electrodeposited coatings as opposed to impregnated coatings was removed by subsequent profiling with diamond profile grinding wheels, so that accurate tolerances for workpieces could be achieved up to a certain limit. The grain wear of the engaged tools is uneven and commences in those areas that are subjected

to the greatest load such as at the edges or the projected radii so that recoating usually becomes necessary when the coating has worn away at only one point. For all practical purposes this amounts to a new coating. Efforts were therefore directed towards adapting the conventional grinding technique, involving the crushing of a profile onto the wheel periphery with the aid of a crushing device mounted on a grinding machine, to diamond and CBN grinding wheels. A prerequisite for this was to develop a bonding material which could be profiled by crushing. This method opened up new possibilities, particularly for deep and full cut grinding.
Author

N84-15295# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
MEASURES AGAINST ERRORS IN THE BUILDING PROCESS
Miroslav Matousek 1983 217 p refs Transl. into ENGLISH from a Swiss document
(NRC/CNR-TT-2067; ISSN-0077-5606; Ser-246) Avail: NTIS HC A10/MF A01

The individual sources of human error are described, and possible countermeasures are described. The important factors necessary for the classification of the individual countermeasures, and the interrelationships of these factors to be considered are introduced. Feed-back from previous experiences, (in particular from near failures or from actual failures), as well as the aims and influence of research are also considered. The sources of error in the technical procedures of the building process and measures for avoiding them are described. The sources of error in the organization and management sector of the building process assuming "error-free" technical procedures and "error-free" behavior of the people concerned are considered. The sources of error resulting from human behavior assuming "error-free" technical procedures and "error-free" organization and management are also considered.
Author

N84-15296# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ELASTOMERIC IMPRESSION MATERIALS AND CLEANING SYSTEMS FOR RESIDUE REMOVAL
Thomas M. Prochazka 31 Jan. 1983 18 p
(Contract DE-AC04-76DP-03533)
(RFP-3442) Avail: NTIS HC A02/MF A01

A materials evaluation program was conducted to characterize castable resin compounds as suitable dimensional inspection aids. A fast curing dimethylsilicone based compound was selected as the best performer of the eleven compounds tested. Evaluation of physical properties revealed an inherent problem of particle adherence to metal surfaces tested. A cleaning study was conducted to determine the effectiveness of the solvent systems in removing particulate matter from test surfaces. Silicon residues which can adversely affect bonding characteristics of the metals were identified in cleaning study tests. One solvent system composed of alkylarylsulfonic acids, toluene, and dichloromethane, gave superior results in breaking down and removing these polymerized compounds.
Author

N84-15297# Rockwell International Corp., Golden, Colo. Energy Systems Group.
FURTHER ABBREVIATION OF THE MACHINING SCHEDULE FOR PRODUCING SURFACE-DAMAGE-FREE BERYLLIUM
Stanley Beitscher, Wilbur L. Johns, Richard R. Corle, James R. Luckow, Steven A. Hoover, Albert G. Grimes, and G. A. Riordan, ed. 25 Mar. 1983 17 p refs
(Contract DE-AC04-76DP-03533)
(DOE/TIC-4500-Rev-69; RFP-3455) Avail: NTIS HC A02/MF A01

The feasibility of reducing the number of finishing lathe cuts in the machining of beryllium that must be free of surface damage after subsequent heat treating or etching was evaluated. Tensile, impact, and bend tests were used to determine the effects of surface damage on the mechanical properties. Optical and electron microscopic examinations were used to determine the metallographic effects of surface damage. Four different machining schedules were evaluated. The results indicate that a carefully controlled one-finishing pass method is equivalent to the carefully controlled two-finishing pass method presently being used to produce damage-free beryllium at Rocky Flats. Scanning electron microscopy indicated new information concerning the damage on machined beryllium surfaces. Sharply and deeply cracked or torn regions of metal about 1/2 mil or 10 microns in width appear periodically along the machining striations.
M.G.

N84-15298# National Physical Research Lab., Pretoria (South Africa).
PROCEEDINGS OF SYMPOSIUM ON SURFACE SCIENCE AND ITS INDUSTRIAL IMPLICATIONS
1981 221 p refs Symp. held in Pretoria, 26-27 Nov. 1981; sponsored by the African Inst. of Physics, the Vacuum Soc. of South Africa, and the Natl. Phys. Res. Lab.
(ISBN-0-7988-2417-4) Avail: NTIS HC A10/MF A01

Auger electron spectroscopy, topography and defects, surface analysis, thin films, sputtering, surface reactions, segregation and diffusion, flotation, and nucleation were discussed with emphasis on technology transfer. For individual titles, see N84-15299 through N84-15326.

N84-15299# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
THE MEASUREMENT OF SURFACE TEXTURE AND ITS CORRELATION WITH FUNCTION **c35**
T. O'D. Duggan *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 3-11 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The problem of measuring, characterizing, and specifying the texture of manufactured surfaces is surveyed. The methods of measurement commonly available together with indices and parameters are briefly outlined and discussed. Mention is made of some of the more recent investigations and attempts to derive more descriptive parameters. A final conclusion is offered that stylus methods will continue to predominate for some time to come.
Author

N84-15300# Natal Univ., Pietermaritzburg (South Africa). Dept. of Physics.
ETCHING OF DEFECTS ON CRYSTAL SURFACES **c76**
P. J. Jackson *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 13-19 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The etching of crystal surfaces is widely used to reveal the distribution of crystal defects which intersect the surface. The methods of specimen preparation are outlined, and the results of the dislocations of the crystals are described.
Author

N84-15301# Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik.
SURFACE ANALYSIS BY PARTICLE BEAMS **c76**
F. Viehboeck, P. Braun, and F. Ruedenauer *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 23-29 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The composition, structure and electronic properties of solid surfaces is of importance in divergent fields such as microelectronics, corrosion research, biology, geology, etc. Some of the analytical techniques such as Auger electron spectroscopy (AES), ion scattering spectroscopy (ISS), secondary ion mass spectroscopy (SIMS), and Rutherford backscattering spectroscopy (RBS) have in common the use of charged particles. Quantification methods for these techniques and their analytical limitations, such as lateral and depth resolution, are surveyed. The sensitivity aspect of the two most frequently used methods, AES and SIMS, is also discussed.
Author

N84-15302# Witwatersrand Univ., Johannesburg (South Africa). Nuclear Physics Research Unit.

SURFACE AND NEAR-SURFACE ANALYSIS OF DIAMOND BY RBS c76

T. E. Derry and J. P. F. Sellschop *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 31-37 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Rutherford backscattering of MeV energetic ions has became a popular method for obtaining information about the near surface region of solids. Although not a true surface technique, it is capable of yielding surface specific information in certain cases. Examples drawn from work on diamond in our laboratory are described; they enable some interesting conclusions to be reached on the nature of the diamond surface. Author

N84-15303# Perkin-Elmer and Co. G.m.b.H., Munich (West Germany). Physical Electronics Div.

EXPERIENCE IN SURFACE ANALYSIS APPLIED TO TECHNICAL MATERIAL PROBLEMS c25

H. Goretzki *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 39-47 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Auger Electron Spectroscopy (AES) is an analytical method used to determine the chemical composition of surfaces and thin films with a depth resolution of 5 to 20 A. Surface related material problems such as corrosion, oxidation, wear, adhesion and catalysis are solved by AES. High resolution scanning AES provides analytical capabilities for the sub-micron range which is particularly important for microelectronics and metallurgical applications. In industry AES is used for quality control, failure analysis and materials development. Author

N84-15304# Port Elizabeth Univ., Cape Province (South Africa). Dept. of Physics.

SURFACE PHOTOLUMINESCENCE AND IT APPLICATION c25

H. Booyens and J. H. Basson *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 49-53 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Photoluminescence is discussed as a technique for studying surfaces of single crystal semiconductor materials. Examples are given of photoluminescence applied in topographical mode and as a means of studying surface electronic states. Author

N84-15305# National Electrical Engineering Research Inst., Pretoria (South Africa).

INTEGRATED CIRCUIT FAILURE MECHANISM DETECTED BY IMMA c33

M. Crooke *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 55-61 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Unanticipated lateral field effect transistor (FET) action was observed between parts of an integrated circuit (IC) during electrical probing. Although comprehensive electrical investigation lead to the identification of potentially suspect areas, and reduced the possible origins of the problem to three, it was only after application of the techniques of ion microprobe mass analysis (IMMA) in the suspect areas that the problem was unambiguously identified. Based on this, a mechanism of failure was proposed which was subsequently confirmed by direct observation of the critical event. Author

N84-15306# Muenster Univ. (West Germany). Inst. fuer Physikalisches.

SECONDARY ION EMISSION FROM ADSORBATE LAYERS ON POLYCRYSTALLINE NI c76

M. Schemmer, P. Beckmann, D. Griefendorf, and A. Benninghoven *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 63-71 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Complex surface reactions were investigated by static secondary ion mass spectrometry (SIMS). For many types of surface compounds, coverage proportional values are derived from SIMS intensity ratios of the type Ni(m)A(+)/Ni(sub m)(+) where A stands for the adsorbed species. By this consideration of intensity ratios, existing models of the Ni-C2H4 interaction could not only be confirmed, but even extended. Author

N84-15307# Zimbabwe Univ., Salisbury. Dept. of Mechanical Engineering.

THE USE OF AUGER ELECTRON SPECTROSCOPY AND ELLIPSOMETRY IN THE STUDY OF CORROSION INHIBITION c76

Gladius Lewis *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 75-81 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The techniques of Auger electron spectroscopy and ellipsometry are applied to the study of the surface films formed on copper in aqueous solutions containing an inhibitor, benzimidazole. The results show the surface film to be nonstoichiometric, 64 nm thick, with an approximate composition and optical constant of Cu6N5-5O2 and 1.50(1 - 0.02i), respectively. M.G.

N84-15308# National Physical Research Lab., Pretoria (South Africa).

A NEW NON-DESTRUCTIVE AND STANDARDLESS METHOD FOR THE THICKNESS DETERMINATION OF THIN FILMS BY XRF MEASUREMENT c38

W. H. Gries and F. T. Wybenga *In its* Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 83-89 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The thickness of thin uniform films can be determined by measuring the signal ratio of a fluorescent line at two different take-off angles and using the result in either of two mathematical relationships which link the ratio to the film thickness. A zinc sulphide film on silica is used as an example for application of this method. Author

N84-15309# Eloptro Aanleg van Kentron, Kemptron Park (South Africa).

THE INFLUENCE OF WEAKLY POLARIZED SURFACES ON DIFFERENT KINDS OF THIN LAYER SYSTEMS [DIE INVLOED VAN SWAK GEPOLEERDE OPPERVLAKKE OP VERSKILLENDE DUNLAGIESISTEME] c74

H. F. B. Minnaar *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 91-97 In AFRIKAANS; ENGLISH summary (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

After exposure to certain temperature and humidity tests and in some cases before such tests, dielectric multi-layers and metal dielectric multi-layers coated on optical glass, showed optical and cosmetic properties that deviated from the normal. Investigation of this problem showed that the main reason for the deviations was the quality of the substrates before coating. The influence of the substrate quality on the performance of thin film coatings are discussed in the light of results from different experiments. Author

N84-15310# Chamber of Mines, Johannesburg (South Africa). International Gold Corp.

THE UNIQUE SURFACE PROPERTIES OF GOLD c26

G. Gafner *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 99-105 (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The consequences of gold's nobility, optical and catalytic properties are discussed with reference to some of its industrial uses. Applications in architecture, solar cell barriers, chemical engineering, and electrical contacts are addressed. M.G.

N84-15311# South African Copper Development Association (Pty) Ltd., Marshalltown.

SURFACE COATING SYSTEMS FOR COPPER AND COPPER

ALLOYS c26
I. Ogilvie *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 107-112 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Work carried out in three areas involving the surface phenomenon associated with the coating of copper is reviewed. The provision of a temporary protection to copper surfaces during storage and shipping is an important consideration. Two methods of providing stable oxide coatings are given. The development of a low cost selective surface for copper solar absorbers, used for low temperature applications is discussed. The absorptance/emittance values of existing methods are compared. Factors affecting the degradation of polymeric coatings used for electrical insulation are discussed. A possible mechanism involving the migration of copper ions is proposed. M.G.

N84-15312# Minnesota Univ., Minneapolis. Lab. for Physical Electronics.
SPUTTERING OF MULTICOMPONENT MATERIALS c24
G. K. Wehner *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 117-129 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

A survey is given of present knowledge of: (1) preferential sputtering of certain species in multielement materials; (2) the subsequent formation of a near surface layer with altered composition; (3) the total sputtering yields as function of composition after steady-state conditions are established; and (4) the angular ejection distribution of different species. The basic differences between single phase alloys or compounds and multi-phase alloys and materials with volatile species are described. M.G.

N84-15313# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Physics.
A FORMULA FOR THE SPUTTERING YIELD OF POLYCRYSTALLINE MATERIALS c27
G. N. vanWyk and A. H. Lategan *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 131-135 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

A model is proposed to test the applicability of Sigmund's theory to polycrystalline copper targets. The amount of fortuitous channelling in a polycrystalline target is determined by a method of integration and the sputtering coefficient is calculated by using a combination of single crystal sputtering theory and Sigmund's formula. Results for Cu(+) ions on a copper target are presented. M.G.

N84-15314# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Grenzflaechenforschung und Vakuumphysik.
QUANTITATIVE SPUTTER PROFILING AT SURFACES AND INTERFACES c27
J. Kirschner and H. W. Etzkorn *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 137-144 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The key problem in quantitative sputter profiling, that of a sliding depth scale, was solved by combined Auger/X-ray microanalysis. By means of this technique and for the model system Ge/Si (amorphous) the following questions are treated quantitatively: shape of the sputter profiles when sputtering through an interface, and origin of their asymmetry; precise location of the interface plane on the depth profile; broadening effects due to limited depth of information and their correction; origin and amount of bombardment induced broadening for different primary ions and energies; depth dependence of the broadening, and basic limits to depth resolution. Comparisons are made to recent theoretical calculations based on recoil mixing in the collision cascade and very good agreement is found. Author

N84-15315# Pretoria Univ. (South Africa). Dept. of Physics.
DEPTH RESOLUTION DUE TO INSTRUMENTAL FACTORS IN SPUTTER-ASSISTED DEPTH PROFILING c26
J. B. Malherbe *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 147-152 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Various instrumental factors which can influence the depth resolution when sputter profiling with a static Gaussian ion beam are discussed together with a surface sensitive analytical technique. Calculations show that the contribution of these factors to the total depth resolution may usually be ignored. Author

N84-15316# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Physics.
OXYGEN ADSORPTION AND INITIAL OXIDATION OF SINGLE CRYSTAL FIRST ROW TRANSITION METAL AND ALLOY SURFACES c25
J. P. Roux *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 157-167 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The metals iron, cobalt and nickel as well as two nickel-iron alloys basically follow the same three stage process during their initial reaction with oxygen. The Ni(100)/O2 system is used as the reference model in this review. Author

N84-15317# Bonn Univ. (West Germany). Div. of Nuclear Chemistry.
KINEMATICS OF THE STRUCTURE AND MORPHOLOGY DURING SURFACE REACTIONS BETWEEN TRANSITION METALS AND MOLECULAR HYDROGEN c26
L. C. vonErichsen, H. Meusemann, H. Haverkamp, F. Luckner, A. Maas, S. M. Hosseini (Kabul Univ.), and H. Urbahn (Gesellschaft fuer Reaktoricherheit) *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 169-175 refs Sponsored in part by the Deutsche Forschungsgemeinschaft (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

A technique characterized by the in-situ SEM observation of interface morphology kinematics is described. Results obtained with hydrogen gas and the transition metals, V. Nb, Ta, Ti, Zr, Hf and Y are presented. Author

N84-15318# National Physical Research Lab., Pretoria (South Africa).
USE OF SCANNING ELECTRON MICROSCOPY IN STUDYING SURFACE REACTIONS OF METALS WITH HYDROGEN c26
C. M. Stander *In its* Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 177-183 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The use of scanning electron microscopy for studying the morphology of layers of compounds formed on metals is illustrated using the formation of magnesium hydride on magnesium metal as an example. The role of twinning in determining the morphology is stressed with particular reference to compounds having rutile structures. Author

N84-15319# Orange Free State Univ., Bloemfontein (South Africa). Dept. of Physics.
SURFACE SEGRATION AND DIFFUSION INVESTIGATIONS BY MEANS OF AES c25
P. E. Viljoen, F. Bezuidenhout, J. duPlessis, J. A. J. Lourens (Randse Afrikaanse Univ.), G. L. P. Berning, and J. P. Roux *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 187-193 refs Sponsored in part by CSIR and the Research Fund of the UOFS (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Auger electron spectroscopy was used in the study of bulk to surface segregation of carbon, silicon and phosphorous in Fe-Si(110) crystals containing 10 and 6 at. % Si. This leads to the identification and investigation of several processes. Phosphorus and silicon segregation and diffusion limited processes

while observed changes in the carbon Auger lineshape reveals reaction limited processes. In the case of carbon and silicon, the segregated atoms form islands on the surface. The expected combination of segregation and island formation was observed for carbon and silicon. Activation energies were determined from Arrhenius plots for such process. The value for phosphorus segretation is too high and leads to the calculation of a bulk interaction energy of 22 kJ/mol between phosphorus and silicon.
Author

N84-15320# Perkin-Elmer and Co. G.m.b.H., Munich (West Germany). Physical Electronics Div.
GRAIN BOUNDARY SEGREGATION AND CAVITY FORMATION IN CREEP EMBRITTLED Cr-Mo STEELS c26
H. Goretzki, U. Franzoni, and S. Sturlese (Centro Sperimentale Metallurgico) *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 195-201 refs Sponsored in part by the European Coal and Steel Community (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

A creep embrittled chromium-molybdenum steel was investigated by high resolution scanning Auger analysis of freshly fractured surfaces. Cavity formation at the grain boundaries of the creep samples was observed. The impurity element sulphur, tin, antimony and copper segregated exclusively to the cavities while phosphorus was enriched preferentially at the cavity-free grain boundary surfaces. In the cavities, phosphorus is present in low surface concentrations. There,is an competitive segretation process between this and the other impurity elements. Phosphorus has a key role in creep embrittlement. It enhances the heterogeneous cavity nucleation at the grain boundaries. S, Sn, Sb and Cu may contribute to cavity growth.
Author

N84-15321# Pretoria Univ. (South Africa). Dept. of Materials Science and Metallurgical Engineering.
EVALUATION OF THE PITTING CORROSION RESISTANCE OF A Fe-12% Cr ALLOY c26
R. F. Sandenbergh *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 205-210 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The pitting corrosion resistance of the steel was determined by potentiodynamic "breakdown potential" measurements. The presence of pits at potentials more positive than the breakdown potential were verified by microscopic examination. Increased temperature and chloride contents led to more positive pitting potentials. In near neutral solutions at ambient temperatures pitting should not occur in this steel if the chloride content of the solution is less than 2500 ppm.
Author

N84-15322# National Inst. for Metallurgy, Randburg (South Africa).
THE DESCALING OF 3Cr12 STEEL c26
R. L. Paul and P. E. L. Balestra *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 213-217 (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The descaling of 3CR12 steel was studied in various mineral acids (H2SO4, HNO3, and HF) and in acid mixtures (H2SO4 + HF, and HNO3 + HF), as a function of temperature and immersion time. The descaled metal surface after the metal has been pickled in a non-oxidative acid (H2SO4 or HF) is black in color, owing to the presence of small particles of titanous sulphide loosely adhered to the surface. The sulphide particles, present in the metal as intergrowths with titanium carbide, are exposed on the surface as the surrounding metal is corroded away. However, when the metal surface is descaled in an oxidizing acid (e.g., HNO3 + HF), the particles of titanous sulphide are oxidized as soon as they are exposed on the surface, and the descaled surface has a shiny, metallic appearance. These results are explained in terms of an electrochemical model.
Author

N84-15323# National Inst. for Metallurgy, Randburg (South Africa).
SURFACE CHEMISTRY IN THE FLOTATION OF MINERALS c26
P. J. Harris *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 221-226 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

Five stages are identified in the concentration of minerals by flotation: (1) preparation of a relatively narrow size range of particles whose surface activity may depend on the method by which the ore is broken down; (2) the selective interaction of reagents at the mineral-solution interface to form a hydrophobic surface and, if necessary, the selective formation of hydrophilic surfaces to prevent already hydrophobic mineral particles from floating; (3) the formation and distribution of air bubbles in the pulp by the addition of ce-active agents; (4) interactions between the particles themselves and between the particles and the air bubbles leading to the attachment of the selected minerals to the air bubbles; and (5) the formation of a froth whose stability is critical to the selection process and whose stability is also influenced by the particles themselves.
Author

N84-15324# National Inst. for Metallurgy, Randburg (South Africa).
SPECTROSCOPIC STUDIES ON SURFACE REACTIONS BETWEEN MINERALS AND REAGENTS IN FLOTATION SYSTEMS c25
E. W. Giesekke *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 229-235 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The adsorbed species at the interface between minerals and an aqueous solution were studied. The results of infrared spectroscopic studies of the fluorite-sodium oleate and fluorite-linoleate systems are cited. Electron spectroscopy for chemical analysis (ESCA) was also useful in the identification of adsorbed species on mineral surfaces. Some experimental data from the literature are discussed. These studies have the disadvantage that they are not ir situ investigations of the interface between the mineral and the aqueous solution. The potential use of other spectroscopic techniques are discussed, photoacoustic, Raman, and electron-spin-resonance spectroscopy being considered as possible alternatives. It is suggested that the relatively small surface areas of minerals used in flotation impose severe restrictions on the use of such techniques.
Author

N84-15325# Pretoria Univ. (South Africa). Dept. of Chemistry.
THE HETEROGENEOUS NUCLEATION OF ICE I c25
J. C. Davidtz and P. L. Mouton *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 239-245 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

The heterogeneous nucleation of ice 1 by a smectite with various exchangeble ions was studied. It was found that the greater the degree of mismatch between the exchangeable cation and the hexagonal ring cavity of the smectite, the warmer was the nucleation temperature. In homogeneous nucleation, urea induced nucleation at colder temperatures.
Author

N84-15326# Pretoria Univ. (South Africa). Fisikadepartement.
STRUCTURAL PROPERTIES OF EPITAXIAL SINGLE LAYER METALS ON (110) B.C.C. METAL SUBSTRATES [STRUKTUUR VAN EITAKSIALE MONOLAE VAN METALE OP (110) B.C.C. METAALSUBSTRATE] c76
Jan H. vanderMerwe *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 249-256 refs In AFRIKAANS; ENGLISH summary (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

A phenomenological models, based largely on symmetry considerations was used to pedict ideal epitaxia, configurations, in particular, the Nishiyama-Wassermann and Kurdjumov-Sachs orientations, depending on the rigid limit only. In the harmonic approximation, the accommodation of misfit was investigated and a phase diagram of one- and two-dimensional coherences constructed.
Author

N84-15327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REFRIGERATION FOR CRYOGENIC SENSORS
Max G. Gasser, ed. Washington Dec. 1983 430 p refs Conf. held in Greenbelt, Md., 7-8 Dec. 1982
(NASA-CP-2287; Rept-83F5158; NAS 1.55:2287) Avail: NTIS HC A19/MF A01 CSCL 20L

Research in cryogenically cooled refrigerators is discussed. Low-power Stirling cryocoolers; spacecraft-borne long-life units; heat exchangers; performance tests; split-stirling, linear-resonant, cryogenic refrigerators; and computer models are among the topics discussed. R.J.F.

N84-15328*# Naval Research Lab., Washington, D. C.
US NAVY PROGRAM IN SMALL CRYOCOOLERS
M. Nisenoff and E. A. Edelsack *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 1-11 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 02L

A Navy program to develop fractional-watt cryocoolers capable of operating below 10 K is discussed. Several varieties of Stirling coolers were built and are under evaluation. In addition, helium gas compressors designed for use with small, closed cycle Joule-Thomson coolers are under development. An overview of the technical aspects of the program are presented. R.J.F.

N84-15329*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA NEEDS AND TRENDS IN CRYOGENIC COOLING
Allan Sherman *In its* Refrig. for for Cryogenic Sensors Dec. 1983 p 13-27 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

Projected NASA needs in spaceborne cryogenic systems and recent results of NASA cryogenic cooling technology efforts in infrared astronomy, X-ray astronomy, gamma ray astronomy, liquid helium and space stations are discussed. R.J.F.

N84-15330*# Tohoku Univ., Sendai (Japan). Dept. of Physics.
JAPANESE ACTIVITIES IN REFRIGERATION TECHNOLOGY
T. Fujita, T. Ohtsuka, and Y. Ishizaki *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 33-46 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

Recent activities in refrigeration technology in Japan are discussed. Stirling cycle refrigerators and magnetic refrigerators are discussed. The development of units for use on trains is discussed. R.J.F.

N84-15331*# Aerospace Corp., El Segundo, Calif.
SPACECRAFT-BORNE LONG LIFE CRYOGENIC REFRIGERATION: STATUS AND TRENDS
Alfred L. Johnson *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 47-79 refs (For primary document see N84-15327 06-31)
(Contract F04701-82-C-0083)
Avail: NTIS HC A19/MF A01 CSCL 20L

The status of cryogenic refrigerator development intended for, or possibly applicable to, long life spacecraft-borne application is reviewed. Based on these efforts, the general development trends are identified. Using currently projected technology needs, the various trends are compared and evaluated. The linear drive, non-contacting bearing Stirling cycle refrigerator concept appears to be the best current approach that will meet the technology projection requirements for spacecraft-borne cryogenic refrigerators. However, a multiply redundant set of lightweight, moderate life, moderate reliability Stirling cycle cryogenic refrigerators using high-speed linear drive and sliding contact bearings may possibly suffice. Author

N84-15332*# SHE Corp., San Diego, Calif.
REGENERATION EXPERIMENTS BELOW 10K IN A REGENERATIVE-CYCLE CRYOCOOLER
Ronald E. Sager and Douglas N. Paulson *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 81-94 refs Sponsored by DOE (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

At temperatures below 10K, regenerative cycle cryocoolers are limited by regeneration losses in the helium working fluid which result from the decreasing heat capacity of the regenerating material and the increasing density of helium. Experiments examining several approaches to improving the low-temperature regeneration in a four-stage regenerative cycle cooler constructed primarily of fiberglass materials are discussed. Using an interchangeable fourth stage, the experiments included configurations with multiple regeneration passages, and a static helium volume for increased heat capacity. Experiments using helium-3 as the working fluid and a Malone stage are planned. Results indicate that, using these techniques, it should be possible to construct a regenerative cycle cooler which will operate below 6K. R.J.F.

N84-15333*# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
A CRYOCOOLER FOR APPLICATIONS REQUIRING LOW MAGNETIC AND MECHANICAL INTERFERENCE
J. E. Zimmerman, D. E. Daney, and D. B. Sullivan *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 95-105 refs Sponsored by ONR (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

A very low-power, low-interference Stirling cryocooler is being developed based on principles and techniques described in several previous publications over the last four years. It differs in several important details from those built previously. It uses a tapered displacer based upon an analytical optimization procedure. The displacer is driven by an auxiliary piston and cylinder (rather than by mechanical linkage) using some of the working fluid itself to provide the driving force. This provides smooth, vibration-free motion, and, more importantly, allows complete mechanical and spatial separation of the cryostat from the pressure-wave generator. Either of two different pressure-wave generators can be used. One is a non-contaminating, unlubricated ceramic piston and cylinder. The other is a compressed-air-operated rubber diaphragm with motor-driven valves to cycle the pressure between appropriate limits. Author

N84-15334*# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.
AN APPROACH TO OPTIMIZATION OF LOW-POWER STIRLING CRYOCOOLERS
D. B. Sullivan, R. Radebaugh, D. E. Daney, and J. E. Zimmerman *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 107-130 (For primary document see N84-15327 06-31)
(Contract N00014-82-F-0040)
Avail: NTIS HC A19/MF A01 CSCL 20L

A method for optimizing the design (shape of the displacer) of low power Stirling cryocoolers relative to the power required to operate the systems is described. A variational calculation which includes static conduction, shuttle and radiation losses, as well as regenerator inefficiency, was completed for coolers operating in the 300 K to 10 K range. While the calculations apply to tapered displacer machines, comparison of the results with stepped displacer cryocoolers indicates reasonable agreement. R.J.F.

N84-15335*# Simon Fraser Univ., Burnaby (British Columbia). Dept. of Physics.
REGENERATION EFFICIENCY, SHUTTLE HEAT LOSS AND THERMAL CONDUCTIVITY IN EPOXY-COMPOSITE ANNUALR GAP REGENERATORS FROM 4K TO 80K
Ken Myrtle, Suso Cygax, Chris Plateel, and Calvin Winter *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 131-140 refs Sponsored by British Columbia Science Council (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

A test apparatus designed to simulate a section of a Stirling

cycle cryocooler was built. Measurements of regeneration efficiency, shuttle heat loss and thermal conductivity reported for several regenerator test sections. The test composites were epoxy glass, epoxy glass with lead particles, epoxy glass with activated charcoal and epoxy graphite. Losses measured for these materials were approximately the same. Losses are in good agreement with those calculated theoretically for an epoxy glass (C-10) composite. The implications of these results on cryocooler design are discussed. R.J.F.

N84-15336*# Philips Labs., Briarcliff Manor, New York.
A 10 DEG K TRIPLE-EXPANSION STIRLING-CYCLE CRYOCOOLER
W. Newman and C. S. Keung *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 141-156 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

The design of a triple expansion closed cycle Stirling cryocooler optimized for a cooling load of 50 mW at 10 K is described. The cooler was designed with the objectives of low power, low weight, compactness, low mechanical motion, low electromagnetic noise, and low output temperature fluctuations. The design employs a direct drive linear motion piston motor and a triple expansion free displacer. Piston motion is controlled by feedback from an optical position transducer. Mechanical vibrations are attenuated with a passive resonant counterbalance. Electromagnetic noise is attenuated with layered high permeability magnetic shielding. The regenerators move with the displacer within a thin titanium cold finger. The piston and displacer oscillate at 8.33 Hz on bearings and seals of reinforced Teflon. The cooler is designed to provide the desired 50 mW of cooling at 10 K with a power input of less than 100 W. The piston can be driven at a greater stroke to produce up to 200 mW of cooling with an input power of 250 W. A lead and copper cold tip heat exchanger will limit temperature fluctuations to within 0.01 K. R.J.F.

N84-15337*# Nihon Univ., Tokyo (Japan). Atomic Energy Research Inst.
AN APPLICATION OF GAP REGENERATOR/EXPANDER PRECOOLED BY TWO STAGE G-M REFRIGERATOR
Y. Matsubara and K. Yasukochi *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 157-168 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

The degradation of regenerator effectiveness below 10K is due to the imbalance of the heat capacity of the regenerator material and helium gas as a working fluid. One of the attractive methods to increase this efficiency could be realized by a gap regenerator system regarding helium gas property. This paper describes an experiment using pressurized helium gas as a regenerator material. A two stage G-M cycle refrigerator has been used for precooling the gap regenerator system. With this method, minimum temperature below 5K has been obtained when the precooling temperature maintained at 10K. Author

N84-15338*# Suzuki Shokan Co. Ltd. (Japan). Cryogenic Dept.
COMPACT CLAUDE CYCLE REFRIGERATOR FOR LABORATORY USE
Y. Hiersaki, M. Kaneko, T. Munekata, Y. Baba, Y. Matsubara (Nihon Univ., Tokyo), and K. Yasukochi (Nihon Univ., Tokyo) *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 169-177 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

A Claude cycle refrigerator with a three stage reciprocating expansion engine is described. Instead of a cam mechanism, valves are driven directly by magnetic solenoids operated by means of a micro processor control system. A swash plate mechanism is used to convert reciprocating motion of the expander pistons to rotary motion. A refrigeration capacity of 8 watts was achieved at 4.5 K with the operating pressure of 1.1 MPa and flow rate of 2.4 g/sec.. An effect of overintake operation was studied. Experimental results show that the efficiency of the expander has a peak point in the region of overintake operation with constant cycle speed, which agrees with theoretical results. The electrically controlled valve system is useful to vary the valve timing to achieve an optimum condition of operation. Author

N84-15339*# Sumitomo Heavy Industries Ltd., Hiratsuka (Japan).
A SMALL AND LIGHT WEIGHT HEAT EXCHANGER FOR ON-BOARD HELIUM REFRIGERATOR
T. Koizumi, M. Takahashi, T. Uchida, Y. Kanazawa, and M. Suzuki *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 179-188 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

A small and light weight heat exchanger used for small helium refrigerator has been developed by Sumitomo Heavy Industries, Ltd. This heat exchanger is a laminated metal heat exchanger which consists of perforated aluminum metal plates and glassfiber reinforced plastic separators. The size is from 100 mm to 28 mm in diameter and about 300 mm in length. The weight is from 2.5 kg to 0.6 kg. Also it can be used between room temperature and liquid helium temperature. The thermal efficiency obtained has been more than 96%. The heat exchanger has been practically used for on-board helium refrigerator in Japanese National Railways' superconducting magnetic levitated trains. Author

N84-15340*# Creare, Inc., Hanover, N.H.
A MINIATURE TILTING PAD GAS LUBRICATED BEARING
Herbert Sixsmith and Walter L. Swift *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 189-195 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

This paper describes the design and development of a miniature tilting pad gas bearing developed for use in very small turbomachines. The bearings have been developed for cryogenic turboexpanders with shaft diameters down to about 0.3 cm and rotational speeds up to one million rpm. Cryogenic expansion turbines incorporating this type of bearing should be suitable for refrigeration rates down to about 10 w. Author

N84-15341*# Philips Labs., Briarcliff Manor, New York.
LIFE TEST PERFORMANCE OF A PHILIPS RHOMBIC-DRIVE REFRIGERATOR WITH BELLOWS SEALS
E. Lindale and D. Lehrfeld (Magnavox Electro-Optical Systems, Mahwah, N.J.) *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 197-213 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

In February 1979, four Stirling cycle cryogenic refrigerators, developed by Philips Laboratories for the John Hopkins University/ Applied Physics Laboratory, were launched into orbit aboard the P78-1 spacecraft. The refrigerators were designed to cool the detectors of two identical gamma-ray spectrometers to 77 K reliably for one year. Since launch, the refrigerators, still in orbit, have individually accumulated from 5,000 to over 20,000 hours of operation. As part of those efforts, a refrigerator identical to those in orbit was built, with one significant modification: flexible metal bellows between the crankcase and the working volume to prevent possible contaminants from migrating into the cold region. During the life test of the modified refrigerator, the temperature increase during the first three month run was 0.022 k/day, a negligible level. As of October 1982, the unit has accumulated over 12,300 hours of operation. B.W.

N84-15342*# Magnavox Government and Industrial Electronics Co., Mahwah, N. J. Electro-Optical Systems.
SPLIT-STIRLING, LINEAR-RESONANT, CRYOGENIC REFRIGERATORS FOR DETECTOR COOLING
Daniel Lehrfeld *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 215-229 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

For the past decade, military IR systems have preferred to see cryogenic coolers provided as split units; separating the

functions of compressor and cold-end for system packaging and vibration isolation reasons. A family of split-cycle coolers designed for long MTBF and in the final stages of development is the focus of the discussion. Their technological evolution, from multi-year-MTBF satellite system Stirling coolers developed in the U.S., and the UA 7011 cooler (the first all-linear, military, production cooler) developed in Holland, is explained. Two new split-cycle machines are discussed. They provided 1/4 watt and 1 watt (nominal capacity) at 80 K and 85 K respectively. These linear-resonant, free-displacer Stirling coolers are designed for thousands of hours of service-free operation. They are designed to be compatible with standard U.S. 60 element and 120/180 element detector/dewars, respectively. B.W.

N84-15343*# Mechanical Technology, Inc., Albany, N.Y.
SPLIT-STIRLING-CYCLE DISPLACER LINEAR-ELECTRIC DRIVE
R. A. Ackermann, S. K. Bhate, and D. V. Byrne *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 231-243 ref (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

The retrofit of a 1/4-W split-Stirling cooler with a linear driven on the displacer was achieved and its performance characterized. The objective of this work was to demonstrate that a small linear motor could be designed to meet the existing envelope specifications of the cooler and that an electric linear drive on the displacer could improve the cooler's reliability and performance. The paper describes the characteristics of this motor and presents cooler test results. Author

N84-15344*# Hughes Aircraft Co., El Segundo, Calif. Space and Strategic Engineering Div.
COMPUTER PROGRAM FOR ANALYSIS OF SPLIT-STIRLING-CYCLE CRYOGENIC COOLERS
M. T. Brown and S. C. Russo *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 245-262 refs (For primary document see N84-15327 06-31)
(Contract F33615-79-C-3402)
Avail: NTIS HC A19/MF A01 CSCL 20L

A computer program for predicting the detailed thermodynamic performance of split-Stirling-cycle refrigerators has been developed. The mathematical model includes the refrigerator cold head, free-displacer/regenerator, gas transfer line, and provision for modeling a mechanical or thermal compressor. To allow for dynamic processes (such as aerodynamic friction and heat transfer) temperature, pressure, and mass flow rate are varied by sub-dividing the refrigerator into an appropriate number of fluid and structural control volumes. Of special importance to modeling of cryogenic coolers is the inclusion of real gas properties, and allowance for variation of thermo-physical properties such as thermal conductivities, specific heats and viscosities, with temperature and/or pressure. The resulting model, therefore, comprehensively simulates the split-cycle cooler both spatially and temporally by reflecting the effects of dynamic processes and real material properties. B.W.

N84-15345*# Philips Labs., Briarcliff Manor, New York.
A MAGNETICALLY SUSPENDED LINEARLY DRIVEN CRYOGENIC REFRIGERATOR
F. Stolfi, M. Goldowsky, J. Ricciardelli, and P. Shapiro *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 263-303 refs (For primary document see N84-15327 06-31)
(Contract NAS5-25172)
Avail: NTIS HC A19/MF A01 CSCL 20L

This paper described a novel Stirling cycle cryogenic refrigerator which was designed, fabricated and successfully tested at Philips Laboratories. The prominent features of the machine are an electro-magnetic bearing system, a pair of moving magnet linear motors, and clearance seals with a 25 mu m radial gap. The all-metal and ceramic construction eliminates long-term organic contamination of the helium working fluid. The axial positions of the piston and displacer are electronically controlled, permitting independent adjustment of the amplitude of each and their relative phase relationship during operation. A simple passive counterbalance reduces axial vibrations. The design of the refrigerator system components is discussed and a comparison is made between performance estimates and measured results. Author

N84-15346*# Leybold-Heraeus G.m.b.H., Cologne (West Germany).
GIFFORD-MCMAHON REFRIGERATOR WITH SPLIT COLD HEAD
H.-J. Forth, R. Heisig, and H.-H. Klein *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 305-313 (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

Leybold-Heraeus Co. have developed, built and successful tested a Gifford-McMahon cryocooler with splitted cold head for cooling a cryopump. The refrigerating part of the cold head and the gas flow control device have been separated (splitted cold head) and the distance between them is bridged by only two thin lines for carrying the working gas. Due to this separation the size of the refrigerating part is virtually defined only by the size of the displacers whilst the gas flow control device can be of any desired design. It has been shown that dimensioning of the connecting lines and the corresponding losses became less critical with increasing size of the expander, but additional cooling in proportion to the refrigerating capacity is required. B.W.

N84-15347*# Hansen (R. G.) and Associates, Santa Barbara, Calif.
TESTING AND CHARACTERIZATIONS OF INFRARED SENSOR OVER THE TEMPERATURE RANGE OF 2 KELVIN TO 300 KELVIN
Robert G. Hansen *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 315-321 (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

Various cryogenic techniques were used to evaluate state of the art electro-optic devices. As research, development, and production demands require more sensitive testing techniques, faster test results, and higher production throughput, the emphasis on supporting cryogenic systems increases. The three traditional methods currently utilized in electro-optic device testing are discussed: (1) liquid containment dewars; (2) liquid transfer systems; and (3) closed cycle refrigeration systems. Advantages, disadvantages, and the current state of the art of each of these cryogenic techniques is discussed. E.A.K.

N84-15348*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPTIMAL DESIGN OF GAS ADSORPTION REFRIGERATORS FOR CRYOGENIC COOLING
C. K. Chan *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 323-342 refs (For primary document see N84-15327 06-31)
(Contract NAS7-918)
Avail: NTIS HC A19/MF A01 CSCL 20L

The design of gas adsorption refrigerators used for cryogenic cooling in the temperature range of 4K to 120K was examined. The functional relationships among the power requirement for the refrigerator, the system mass, the cycle time and the operating conditions were derived. It was found that the precool temperature, the temperature dependent heat capacities and thermal conductivities, and pressure and temperature variations in the compressors have important impacts on the cooling performance. Optimal designs based on a minimum power criterion were performed for four different gas adsorption refrigerators and a multistage system. It is concluded that the estimates of the power required and the system mass are within manageable limits in various spacecraft environments. E.A.K.

N84-15349*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A GENERAL COMPUTER MODEL FOR PREDICTING THE

PERFORMANCE OF GAS SORPTION REFRIGERATORS
Katherine B. Sigurdson *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 343-355 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

Projected performance requirements for cryogenic spacecraft sensor cooling systems which demand higher reliability and longer lifetimes are outlined. The gas/solid sorption refrigerator is viewed as a potential solution to cryogenic cooling needs. A software model of an entire gas sorption refrigerator system was developed. The numerical model, evaluates almost any combination and order of refrigerator components and any sorbent-sorbate pair or which the sorption isotherm data are available. Parametric curves for predicting system performance were generated for two types of refrigerators, a LaNi5-H2 absorption cooler and a Charcoal-N2 adsorption cooler. It is found that precooling temperature and heat exchanger effectiveness affect the refrigerator performance. It is indicated that gas sorption refrigerators are feasible for a number of space applications. E.A.K.

N84-15350*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LaNI5 HYDRIDE CRYOGENIC REFRIGERATOR TEST RESULTS
Jack A. Jones *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 357-373 refs (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

A complete LaNi5 hydrogen absorption cryogenic refrigerator system was developed. The system uses low temperature waste heat of approximately 100 C as a power source, and has no moving parts other than self operating valves. The cycle continues automatically by an electronic sequencing timing mechanism for the three compressors which are phased such that a constant supply of high pressure hydrogen gas is provided. It is indicated that with a fully clean hydrogen system, hundreds of thousand cycles should be attainable, even though some degradation may eventually occur. Simple vacuum reactivation of the hydride of moving parts, other than self operating, long life valves, the refrigerators predicted life is extremely long. E.A.K.

N84-15351*# Los Alamos Scientific Lab., N. Mex.
THE THEORY OF AN ACTIVE MAGNETIC REGENERATIVE REFRIGERATOR
J. A. Barclay *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 375-387 refs Sponsored by DOE (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

The adiabatic temperature change with field which is limited to about 2 K/Tesla for ferromagnets near their Curie temperatures by the change of magnetization with temperature and the lattice heat capacity is discussed. Practical magnetic refrigerators operate on a regenerative cycle such as the Brayton cycle. This cycle can be executed through the use of an active magnetic regenerator, i.e., a regenerator composed of magnetic material that is cycled in an out of a magnetic field with appropriate fluid flows. The theory of these devices is predicted by solving the partial differential equations that describe fluid and the magnetic solid. The active magnetic regenerator is described along with the method of calculation. Temperature profiles for a normal regenerator and a magnetic regenerative refrigerator are shown. E.A.K.

N84-15352*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN OF AN ADIABATIC DEMAGNETIZATION REFRIGERATOR FOR STUDIES IN ASTROPHYSICS
Stephen Castles *In its* Refrig. for for Cryogenic Sensors Dec. 1983 p 389-404 (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

An adiabatic demagnetization refrigerator was designed for cooling infrared bolometers for studies in astrophysics and aeronomy. The design was tailored to the requirements of a Shuttle sortie experiment. The refrigerator should be capable of maintaining three bolometers at 0.1 K with a 90% cycle. The advantage are of operations the bolometer at 0.1K. greater sensitivity, faster response time, and the ability to use larger bolometer elements without compromising the response time. The design presented is the first complete design of an ADR intended for use in space. The most important of these specifications are to survive a Shuttle launch, to operate with 1.5 K - 2.0 K space-pumped liquid helium as a heat sink, to have a 90% duty cycle, and to be highly efficient. E.A.K.

N84-15353*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A HELIUM-3 REFRIGERATOR EMPLOYING CAPILLARY CONFINEMENT OF LIQUID CRYOGEN
D. J. Ennis, P. Kittel, W. Brooks, A. Miller, and A. L. Spivak (Transbay Electronics, Richmond, Calif.) *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 405-417 (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

A condensation refrigerator suitable for operation in a zero gravity space environment was constructed. The condensed liquid refrigerant is confined by surface tension inside a porous metal matrix. Helium-4 and helium-3 gases were condensed and held in a copper matrix. Evaporative cooling of confined liquid helium-4 resulted in a temperature of 1.4K. Using a zeolite adsorption pump external to the cryostat, a temperature of 0.6 K was achieved through evaporative cooling of liquid helium-3. The amount of time required for complete evaporation of a controlled mass of liquid helium-4 contained in the copper matrix was measured as a function of the applied background power. For heating powers below 18 mW the measured times are consistent with the normal boiling of the confined volume of liquid refrigerant. At background powers above 18 mW the rapid rise in the temperature of the copper matrix the signature of the absence of confined liquid occurs in a time a factor of two shorter than that expected on the basis of an extrapolation of the low power data. E.A.K.

N84-15354*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CASCADE JOULE-THOMSON REFRIGERATORS
E. Tward and W. A. Steyert *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 419-425 refs (For primary document see N84-15327 06-31)
(Contract NAS7-918)
Avail: NTIS HC A19/MF A01 CSCL 20L

The design criteria for cascade Joule-Thomson refrigerators for cooling in the temperature range from 300 K to 4.2 K were studied. The systems considered use three or four refrigeration stages with various working gases to achieve the low temperatures. Each stage results in cooling to a progressively lower temperature and provides cooling at intermediate temperatures to remove the substantial amount of parasitic heat load encountered in a typical dewar. With careful dewar design considerable cooling can be achieved with moderate gas flows. For many applications, e.g., in the cooling of sensitive sensors, the fact that the refrigerator contains no moving parts and may be remotely located from the gas source is of considerable advantage. A small compressor suitable for providing the gas flows required was constructed. E.A.K.

N84-15355*# Hansen (R. G.) and Associates, Santa Barbara, Calif.
SUITABILITY OF COMMERCIALLY AVAILABLE LABORATORY CRYOGENIC REFRIGERATORS TO SUPPORT SHIPBOARD ELECTRO-OPTICAL SYSTEMS IN THE 10 - 77 KELVIN REGION
R. G. Hansen and E. A. Byrd (Naval Surface Weapons Center, White Oak, Md.) *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 427-430 (For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

The primary development of cryogenically cooled infrared

systems was accomplished by FLIR systems designed for airborne, passive night vision. Essential to the development of these FLIR systems was a family of closed cycle refrigerators which had to meet a limited envelope requirement, utilize a nonlubricated compressor module, and be light in weight. Closed cycle refrigerators accomplished the same cooling function, they use modified oil lubricated reciprocating compressors which are limited in their axis of orientation to an angle of approximately 15-20 degrees maximum from horizon. E.A.K.

N84-15356*# MMR Technologies, Inc., Mountain View, Calif.
LOW COST MICROMINIATURE REFRIGERATORS FOR LARGE UNIT VOLUME APPLICATIONS
Robert M. Duboc, Jr. *In* NASA. Goddard Space Flight Center Refrig. for for Cryogenic Sensors Dec. 1983 p 431-443 refs
(For primary document see N84-15327 06-31)
Avail: NTIS HC A19/MF A01 CSCL 20L

Photolithographic techniques were employed to fabricate small Joule-Thomson refrigerators in laminated substrates. The gas passages of a J-T refrigerator are formed by etching channels as narrow as 50 microns and as shallow as 5 microns in glass plates which are laminated together. Circular refrigerators on the order of 1.5 centimeters in diameter and .75 millimeters thick were produced which cool down to cryogenic temperatures in a few seconds, using Argon or Nitrogen, with no vacuum or radiation insulation. Smaller refrigerators are developed for both faster cooldown and low refrigeration capacity applications. By using this technology, custom refrigerators can be designed to meet specific application requirements. E.A.K.

N84-15357# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.
ABRASION-EROSION RESISTANCE OF CONCRETE MADE WITH TWO AGGREGATES, STONEWALL JACKSON DAM, WEST VIRGINIA Final Report
Terence C. Holland Sep. 1983 26 p
(AD-A133432; WES/MP/SL-83-15; CTIAC-66) Avail: NTIS HC A03/MF A01 CSCL 11/2

The resistance to abrasion-erosion of two concretes made with different coarse aggregates was evaluated. The aggregates used were selected as being representative of those that may be selected for use during construction of Stonewall Jackson Dam. The two coarse aggregates were limestones from different sources. All other concrete ingredients were identical for the two mixtures. Both concretes showed very high abrasion-erosion losses when tested using the Corps of Engineers standard test method. A recommendation was made that coarse aggregates with better wear-resistant properties be selected for use in areas of the structure that may be subjected to abrasion-erosion. Author (GRA)

N84-15358# SHE Corp., San Diego, Calif.
4.0 K CRYOCOOLER PROJECT Final Report
Douglas N. Paulson and Ronald E. Sager 30 Sep. 1983 80 p refs
(Contract DE-FC03-80ER-10692)
(DE84-000332; DOE/ER-10692/T1) Avail: NTIS HC A05/MF A01

The regenerative, shuttle, conduction, and viscous losses to be expected in a nonmagnetic cryocooler were calculated. Materials suitable for use in the low temperature parts of the cooler were identified and tested. A preliminary system for a cryocooler test station and an advanced system for the advanced prototypes cryocooler were designed. A thermal isolation apparatus, or dewar, was designed and fabricated. A single stage Stirling cylinder in a cryocooler configuration was designed, constructed, and tested. It was found that adding He-3 as the working fluid to one configuration improves performance. The problem of building the static He-4 regenerator is addressed. A Malone style stage was designed, constructed, and tested. The magnetic and vibrational signature of the operating cryocooler was measured with an external magnetometer and gradiometer. System reliability is summarized. DOE

N84-15359# Jeppson (Morris R.), Carmel, Calif.
MICROWAVE METHODS AND APPARATUS FOR PAVING AND PAVING MAINTENANCE Final Report, Phase 1
Morris R. Jeppson 24 Jul. 1983 13 p
(Grant DE-FG01-82CE-15146)
(DE84-016306; DOE/CE-15146/T3) Avail: NTIS HC A02/MF a01

The MPH strip-patcher-recycler eliminates most of the conventional patching equipment, operators and the hot-mix plant, and should reduce costs dramatically. In practice, the machine simply drives along over the damaged strip heating it in-place with microwave; roto-mixing it while injecting hot engine exhaust and make up asphalt or conditioners; screening and tamping. A follow up roller completes the job. Traffic control is simpler and work can be performed in cold or damp weather, and more easily at night - if necessary. The design and operation of the MPH machine are described. DOE

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N84-15360*# Massachusetts Inst. of Tech., Cambridge. Gas Turbine and Plasma Dynamics Lab.
ASYMPTOTIC ANALYSIS OF NUMERICAL WAVE PROPAGATION IN FINITE DIFFERENCE EQUATIONS
Michael Giles and W. T. Thompkins, Jr. Mar. 1983 142 p refs
(Contract NAG3-9)
(NASA-CR-175323; NAS 1.26:175323; GT/PDL-171) Avail: NTIS HC A07/MF A01 CSCL 20N

An asymptotic technique is developed for analyzing the propagation and dissipation of wave-like solutions to finite difference equations. It is shown that for each fixed complex frequency there are usually several wave solutions with different wavenumbers and the slowly varying amplitude of each satisfies an asymptotic amplitude equation which includes the effects of smoothly varying coefficients in the finite difference equations. The local group velocity appears in this equation as the velocity of convection of the amplitude. Asymptotic boundary conditions coupling the amplitudes of the different wave solutions are also derived. A wavepacket theory is developed which predicts the motion, and interaction at boundaries, of wavepackets, wave-like disturbances of finite length. Comparison with numerical experiments demonstrates the success and limitations of the theory. Finally an asymptotic global stability analysis is developed. M.G.

N84-15361# Rome Air Development Center, Griffiss AFB, N.Y.
PHASE-ONLY NULLING AT SYMMETRIC PATTERN LOCATIONS
Robert A. Shore Apr. 1983 42 p
(AF Proj. 2305)
(AD-A133128; RADC-TR-83-100) Avail: NTIS HC A03/MF A01 CSCL 20/14

Nulls cannot be imposed in ideal linear array antenna patterns with phase-only weight control at locations symmetric with respect to the main beam if the phase perturbations are restricted to be small. If, however, no restriction is placed on the magnitude of the phase perturbations, then phase-only nulling at symmetric pattern locations is possible. Several examples are presented to illustrate symmetric nulling with phase-only control. The phase perturbations are calculated by a nonlinear programming computer algorithm. The cancellation patterns tend to be interferometric in shape and result in significant distortion over much of the pattern. Author (GRA)

N84-15362# Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.

PASSIVE SOURCE LOCALIZATION FROM SPATIALLY CORRELATED ANGLE-OF-ARRIVAL DATA
Rudolf S. Engelbrecht and R. R. Mohler Jun. 1983 22 p Submitted for publication
(Contract N00014-81-K-0814)
(AD-A133141; OSU-ONR-TR-83-5) Avail: NTIS HC A02/MF A01 CSCL 17/3

Bias and variance equations are presented for two-dimensional location estimators of a nonmoving point source of radiation in an isotropic, stationary random medium. The estimators are calculated from spatially correlated angle-of-arrival data which are collected simultaneously at two sensor positions and assumed to consist of true (unbiased) source angles plus zero-men angular noise with equal variances at both sensors and negligible higher moments. Under these assumptions the square of the estimator bias is, in general, a quadratic function and the estimator variance a linear function of the spatial data correlation coefficient. However, for source ranges much larger than sensor separation, both the bias and the variance tend to increase linearly with decreasing correlation coefficient, whereas they tend to decrease with increasing sensor separation. The combined effect for a distant source in a stationary random medium, when evaluated for typical spatial wavefront autocorrelation functions, is a significant reduction in the estimator bias and variance dependence on sensor separation, as compared to the uncorrelated case. With minor modifications, the same results apply to the equivalent problem of using time-of-arrival data from three colinear sensor positions.
Author (GRA)

N84-15363# City Univ. of New York, N. Y.
LOW RATE TRANSMISSION OF VIDEO SIGNALS USING ADAPTIVE DELTA MODULATION Final Report, 1 Jul. 1980 - 1 Jul. 1983
J. Barba, M. Dressler, and D. L. Schilling 15 Aug. 1983 158 p
(Contract MDA903-80-C-0476)
(AD-A133145) Avail: NTIS HC A08/MF A01 CSCL 17/2

This report describes packet switched voice operation in packet switched networks. The effect of delay in packet reception is considered. A simulation system is described. DSI techniques are discussed as are silence detection algorithms. The second part of this report describes voice modem, speech waveform identification using delta modulation. The results enable digital transmission at significantly reduced rates. Author (GRA)

N84-15364# Naval Air Development Center, Warminster, Pa. Communication Navigation Technology Directorate.
THEORETICAL PREDICTIONS FOR VLF RADIO PROPAGATION
M. P. Paul 22 Aug. 1983 87 p
(X10830)
(AD-A133168; NADC-83062-40) Avail: NTIS HC A05/MF A01 CSCL 20/14

The very low frequency (VLF, 3 to 30 kHz) part of the radio frequency spectrum is characterized by low attenuation rate, high phase and frequency stability, and high signal to noise ratio. Consequently, VLF radio propagation is used for many practical applications, e.g., frequency standardization, clock synchronization, and reliable long-distance radio communications. Because of the distinct advantages of VLF radio propagation, the U.S. Navy will be conducting a balloon-to-balloon-borne cross link communication experiment to study the characteristics of VLF altitude radio propagation. In this Technical Report, an attempt has been made to make theoretical computations of the vertical components of the individual and multimode field strengths as a function of distance based on mode theory. The variations of various ionospheric parameters, e.g., attenuation rates, the heights of the ionospheric reflection point, the height gain factors for an appropriate combination of the transmitting and receiving antenna elevations, along with the presence of the Earth's geomagnetic field, especially for the East-West propagation, have been duly considered. GRA

N84-15365# Ohio State Univ., Columbus. Electroscience Lab.
RADIATION PATTERNS OF AN ANTENNA MOUNTED ON THE MID-SECTION OF AN ELLIPSOID Quarterly Report
Jeung G. Kim and Walter D. Burnside Jul. 1983 49 p
(Contract N00019-81-C-0424)
(AD-A133203; AD-E000546; ESL-714215-2) Avail: NTIS HC A03/MF A01 CSCL 20/14

An efficient numerical solution for the high frequency radiation patterns of an Antenna mounted on the Mid-Section theta(S) = 90 degrees) of an Ellipsoid is studied in this report. The uniform geometrical theory of diffraction (UTD) is the basic approach applied here and the elliptic cylinder perturbation method is used to simulate geodesic paths on the ellipsoid surface. The radiation patterns obtained using this technique are compared to those for prolate spheroid mounted antennas, which have shown good agreement with measured data. Exact agreement between both results for typical spheroid geometry confirms that radiation patterns for ellipsoid mounted antennas can be solved efficiently by this numerical technique. Author (GRA)

N84-15366# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EARTH COVERAGE CORRUGATED HORNS (44.5 GHz AND 20.7 GHz)
Dennis C. Weikle 19 Jul. 1983 27 p
(Contract F19628-80-C-0002; AF Proj. 2029; AF Proj. 6430)
(AD-A133241; TR-656; ESD-TR-83-039) Avail: NTIS HC A03/MF A01 CSCL 09/1

Communications satellites located in geosynchronous orbits will, in addition to more specialized shaped beam of area coverage antennas, generally utilize earth coverage antennas designed to maximize antenna gain over the entire surface of the visible Earth. In the microwave and millimeter wave bands, these antennas are usually conical horns which achieve a minimum gain (G(min)) of 17 - 17.5 dBi at the limb of the Earth. This paper describes the design of a single mode (ME(11)) earth coverage horn that optimizes G(min). Measurements performed over a 5% frequency band on experimental models designed to operate at 20.7 GHz and 44.5 GHz demonstrate a G(min) 17.8 dBi. Other characteristics of the horns are circularly symmetric radiation patterns, low √SWR (1.2), and peak gain of approximately 22.0 dBi. Author (GRA)

N84-15367# Naval Research Lab., Washington, D. C. Search Radar Branch.
CONSIDERATIONS FOR CHOOSING MICROWAVE TRANSISTORS IN HIGH POWER SHIPBOARD SEARCH RADARS Interim Report
R. P. Meixner 30 Sep. 1983 23 p
(SF12131691)
(AD-A133279; NRL-MR-5167) Avail: NTIS HC A02/MF A01 CSCL 17/9

Critical technical considerations for choosing microwave transistors for search radar transmitters are addressed along with review of some basic design and purchasing problems. Some guidelines for achieving reliable designs are given along with a procedure called Thermal Rieke diagrams for presenting impedance, power and temperature dependencies. AN/TPS-59 experience is outlined along with observations concerning expected transistor costs as a fraction of total transmitter costs.
Author (GRA)

N84-15368# Mitre Corp., Bedford, Mass.
EFFICIENT UTILIZATION OF THE DRAMA SERVICE CHANNEL
D. E. Pauley Sep. 1983 58 p
(Contract F19628-81-C-0001; AF Proj. 492B)
(AD-A133286; MTR-8409; ESD-TR-83-202) Avail: NTIS HC A04/MF A01 CSCL 17/2

The DRAMA service channel must provide communications for a variety of users. The architectural implications of configuring the network using conventional multiplexers are examined and several feasible implementations are presented. A high speed communications processor that can be used as a service channel controller is described. Networks configured with the service

channel controller provide greater reliability and flexibility than the multiplexer networks. Author (GRA)

N84-15369# Naval Research Lab., Washington, D. C.
APERTURE EFFICIENCY CONSIDERATIONS IN THE CONVOLUTION SYNTHESIS OF SYMMETRICAL HEXAGONAL ARRAYS Interim Report
J. Paul Shelton and Sharad R. Laxpati 31 Aug. 1983 27 p
(RR02105)
(AD-A133367; NRL-8694) Avail: NTIS HC A03/MF A01 CSCL 09/5

The investigation of the application of null synthesis procedures to planar arrays, described in previous reports by these authors, is continued. The null synthesis of symmetrical hexagonal arrays is evaluated in terms of the maximum achievable aperture illumination efficiency (AIE). Computed values of maximum AIE are presented for hexagonal arrays of 7, 19, 37, 61, and 91 elements using 7-element, 1-parameter canonical arrays (referred to as H(7)). A 19-element 3-parameter canonical array is introduced (H(19)), and maximum AIE is given for arrays of 19, 37, 61, and 91 elements. Contour plots of radiation patterns, showing zero loci and sidelobe levels are presented for both uniformly illuminated and synthesized maximum AIE arrays. Zero loci, sidelobe levels, and aperture illumination distributions are compared for these arrays. Author (GRA)

N84-15370# GTE Sylvania, Inc., Needham Heights, Mass. Communication Systems Div.
BIDIRECTIONAL FIBER OPTIC CABLE ADAPTER Final Technical Report, 30 May 1981 - 15 Dec. 1982
M. Linehan, N. B. Gee, and R. Taylor Feb. 1983 64 p
(Contract DAAK80-81-C-0077; DA Proj. 1L1-62701-AH-92)
(AD-A133371; CECOM-81-C-0077-F) Avail: NTIS HC A04/MF A01 CSCL 17/2

The technical objective of the BIFOCS program was to develop, build, and test a full-duplex single fiber, fiber optic link, operating in the 1.0 micron to 1.6 micron region, capable of transmitting 20 Mb/s data (10 to the -9th power BER) over a range of at least 10 km, with a goal of 15 km. The link MTBF goal was 5 X 10 to the 3rd power hours and operation over a temperature range of 0 to 50 C. The fiber optic cable consisted of sections not exceeding 2 km in length joined by commercially available dry fiber optic connectors. The system performed successfully at ambient temperature over 15 km of cable.
Author (GRA)

N84-15371# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ISSUES CRITICAL TO THE APPLICATION OF ADAPTIVE ARRAY ANTENNAS TO MISSILE SEEKERS
R. L. Trapp and C. H. Ronnenburg Sep. 1983 46 p
(Contract N00024-83-C-5301)
(AD-A133401; JHU/APL/TG-1342) Avail: NTIS HC A03/MF A01 CSCL 17/4

Missile seekers will confront complex and hostile signal environments that can inhibit severely their ability to intercept threatening targets. Dramatic target detection and homing performance improvement in main beam and sidelobe jamming is realizable with a seeker antenna that can optimally adapt, in real time, its response to the signal environment. Adaptive array antennas can be designed to optimize the signal-to-interference-plus-noise ratio by forming pattern nulls directed toward sources of interference while simultaneously maximizing gain in the desired signal direction. Physical and operational missile constraints place severe requirements on an adaptive array. Nevertheless, there are several array configurations and adaptive processors that can satisfy these constraints in the next decade. Technology is a dominant limitation to adaptive array performance in a missile seeker. Signal processors and array implementations using state-of-the-art technology are required. Critical experimentation and representative simulations are needed to establish error effects, preferred adaptive array implementations, detailed requirements, and relative cost estimates. Although an adaptive missile seeker antenna is physically realizable in the next decade, the tradeoffs between cost, complexity, and performance will determine its utility and practicality. Author (GRA)

N84-15372# Pattern Analysis and Recognition Corp., New Hartford, N.Y.
ECM (ELECTRONIC COUNTER MEASURE) SIGNAL DISCRIMINATION AND IDENTIFICATION TECHNIQUES Final Technical Report, 28 Aug. 1980 - 28 Jan. 1983
Robert E. Bozek, Robert J. Dick, and John P. Yermas Apr. 1983 96 p
(Contract F30602-80-C-0285; AF Proj. 2155)
(AD-A133427; RADC-TR-83-86) Avail: NTIS HC A05/MF A01 CSCL 17/4

This effort involved the design, development and test of a stand-alone Electronic Counter Measure (ECM) Signal Monitor (ESIM) for the terrestrial Line-of-Sight (LOS) Defense Communication System (DCS). The system developed monitors the IF and Baseband outputs of up to four digital radios while they are in service, to assess link quality. If ECM signals are detected, the level of interference and type of interference are reported to an operator. Key components of the system are a PDP-II/23 minicomputer, and HP 8581A automatic spectrum analyzer, and a high-speed (60 MHz) analog-to-digital converter. This report provides a history of the project and a functional overview of the system. Author (GRA)

N84-15373# Ohio State Univ., Columbus. Electroscience Lab.
ADAPTIVE ARRAYS FOR MULTIPLE SIMULTANEOUS DESIRED SIGNALS Interim Report
Inder J. Gupta Griffiss AFB, N.Y. RADC Aug. 1983 34 p
(Contract F30602-82-C-0009; AF Proj. 4519)
(AD-A133486; ESL-714258-2; RADC-TR-83-183) Avail: NTIS HC A03/MF A01 CSCL 09/5

Steered beam adaptive arrays for multiple simultaneous desired signals are discussed. It is shown that the performance of a steered beam adaptive array depends upon the range of input signal strengths and the choice of the steering vector. Optimum steering vectors for various input signal strengths are given. All choices of steering vectors are equally effective in the rejection of jammers. Author (GRA)

N84-15374# Naval Surface Weapons Center, White Oak, Md. Underwater Systems Dept.
ADAPTIVE SIGNAL DETECTION FOR THE OPTIMAL COMMUNICATIONS RECEIVER
Robert H. Baran Jun. 1983 30 p
(ZR00001)
(AD-A133498; NSWC/TR-83-236) Avail: NTIS HC A03/MF A01 CSCL 17/2

The problem of weak signal reception in non-Gaussian noise has been shown to have an optimal solution the structure of which involves a no-memory nonlinearity followed by a matched filter. The shape of the nonlinearity is completely determined by the noise amplitude probability density function. The assumptions underlying this theory are examined and applications to radio communication in atmospheric noise are considered. Since the likelihood ratio test on which the theory is based is not a robust procedure, the receiver system must adjust the shape of the nonlinearity to account for the statistics of the prevailing noise environment. Author (GRA)

N84-15375# California Univ., Los Angeles.
ADVANCED TELEPROCESSING SYSTEMS Final Technical Report, 1 Jul. 1977 - 30 Sep. 1981
Leonard Kleinrock 30 Sep. 1981 24 p
(Contract MDA903-77-C-0272; ARPA Order 2496)
(AD-A133525; UCLA-ENG-83-25) Avail: NTIS HC A02/MF A01 CSCL 17/2

This final technical report covers research carried out under a contract which has three primary designated research areas: Multi-Hop Packet Radio Systems, Multi-Access Broadcast on Wires

and Resource Sharing and Allocation. This report summarizes research results in these areas during this period. GRA

N84-15376# Houston Univ., Tex. Dept. of Electrical Engineering.
MILLIMETER WAVE GUIDING STRUCTURES AND ANTENNAS Final Report, 1 Mar. 1982 - 31 Aug. 1983
Stuart A. Long 12 Sep. 1983 23 p
(Contract DAAG29-82-K-0074)
(AD-A133528; ARO-18986.3-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

Cylindrical, rectangular, and hemispherical resonant dielectric antennas have been investigated both experimentally and theoretically. Resonant frequencies radiation patterns, quality factors, and driving point impedance have all been measured and compared with the theoretical predictions. The structure is shown to hold promise as an efficient radiator at millimeter wave frequencies.
Author (GRA)

N84-15377# California Univ., Los Angeles.
ADVANCED TELEPROCESSING SYSTEMS Annual Technical Report, 1 Oct. 1981 - 30 Sep. 1982
Leonard Kleinrock and Mario Gerla 30 Sep. 1982 154 p
(Contracts MDA903-82-C-0064; MDA903-77-C-0272; DARPA Order 2496)
(AD-A133554; UCLA-ENG-83-24) Avail: NTIS HC A08/MF A01 CSCL 17/2

This Annual Technical Report covers research covering the period from October 1, 1981 to September 30, 1982. This contract has three primary designated research areas: packet radio systems, resource sharing and allocation, and distributed processing and control. This report contains abstracts of publications which summarize research results in these areas followed by the main body of the report which is devoted to a study of channel access protocols that are executed by the nodes of a network to schedule their transmissions on multi-access broadcast channel. In particular the main body consists of a Ph.D. dissertation, Channel Access Protocols for Multi-Hop Broadcast Packet Radio Networks. This work discusses some new channel access protocols useful for mobile radio networks. Included is an analysis of slotted ALOHA and some tight bounds on the performance of all possible protocols in a mobile environment. GRA

N84-15378# California Univ., Los Angeles. Dept. of Computer Science.
ADVANCED TELEPROCESSING SYSTEMS Semiannual Technical Report, 1 Oct. 1982 - 31 Mar. 1983
Leonard Kleinrock and Mario Gerla 31 Mar. 1983 229 p
(Contracts MDA903-82-C-0064; MDA903-77-C-0272; DARPA Order 2496)
(AD-A133555; UCLA-ENG-83-26) Avail: NTIS HC A11/MF A01 CSCL 17/2

This Semi-Annual Technical Report covers research covering the period from October 1, 1982 to March 31, 1983. This contract has three primary designated research areas: packet radio systems, resource sharing and allocation, and distributed processing and control. This report contains abstracts of publications which summarize research results in these areas followed by the main body of the report which is devoted to a treatment of single- and multi-hop packet radio systems. In particular, the main body consists of a Ph.D. dissertation, Analysis of Throughput and Delay for Single- and Multi-Hop Packet Radio Networks. The work presents a new approach to evaluating the performance of multi-hop packet radio networks, namely, a study of the times between successful transmissions. Also studied is the behavior of packets in a multi-hop system when a fixed transmission radius is specified and this radius is then optimized for throughput. A Markov chain model is also introduced and solved numerically to evaluate transmission and flow control strategies in these systems. GRA

N84-15379# Massachusetts Inst. of Tech., Cambridge.
DYNAMIC CONTROL OF SESSION INPUT RATES IN COMMUNICATION NETWORKS
Eli Gafni (California Univ.) and Dimitri Bertsekas May 1983 31 p
(Contract N00014-75-C-1183; ARPA Order 3045; NR Proj. 049-383)
(AD-A133572; LIDS-P-1298) Avail: NTIS HC A03/MF A01 CSCL 12/1

The authors consider a distributed algorithm for dynamically adjusting the input rate of each session of a voice or data network so as to exercise flow control. Each session origin receives periodically information regarding the level of congestion along the session path and iteratively corrects its input rate. In this paper they place emphasis on voice networks but the ideas involved are also relevant for dynamic routing and flow control in data networks. GRA

N84-15380# Ohio State Univ., Columbus. Lab. for Electroscience.
THE CALCULATED PERFORMANCE OF SOME RADAR AND TRANSMISSOMETER SYSTEMS IN RAIN AND FOG AT 35, 94, 140 AND 240 GHz, VOLUME 1 M.S. Thesis - Final Report, 1 Apr. 1981 - 31 Jul. 1982
E. L. Utt and C. A. Levis Wright-Patterson AFB, Ohio AFWAL Dec. 1982 148 p 2 Vol.
(Contract F33615-81-C-1437)
(AD-A133587; ESL-713671-2-Vol-1; AFWAL-TR-82-1147-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 17/9

The effects of rain and fog are examined for three transmissometer and three radar systems: double-ended (direct path) with square-wave modulation and square-law detector; single-ended (folded path) with square-wave modulation and square-law detection, single-ended CW with quadrature receiver, single-ended pulsed with post-detection pulse integration, single-ended pulsed with quadrature receiver, and single-ended with linear FM pulse compression. Computer algorithms were developed to find the probability of detection as a function of range for the radar systems, and the signal-to-noise ratio as a function of range for the transmissometer systems. These algorithms are used recursively to determine the range at which specified performance is attained as a function of rain rate of fog liquid water content. Calculated results are presented for exponential drop-size distributions; provision has been made for the extension to other distributions. Volume I contains the theory and results; computer code listings and directions for use of the codes are given in Volume II.
Author (GRA)

N84-15381# Ohio State Univ., Columbus.
COHERENT ELECTROMAGNETIC WAVE PROPAGATION AND SCATTERING IN RANDOM MEDIA Final Report, 16 Nov. 1981 - 30 Jun. 1983
V. K. Varadan and V. V. Varadan Aug. 1983 89 p
(Contract DAAG29-82-K-0013)
(AD-A133601; ARO-17441.7-GS) Avail: NTIS HC A05/MF A01 CSCL 20/14

The effect of multiple scattering on the coherent wave propagation is discrete random media is studied for spherical and non-spherical dielectric scatterers as a function of frequency and volume concentration of scatterers. The first and second order probability distribution functions are specified and a self-consistent T-matrix approach together with Lax's quasi-crystalline approximation is used to derive dispersion equations whose singular solutions yield the complex propagation constant of the 'effective medium'. Various forms of pair-correlations were considered in the analysis; the self-consistent pair-correlation function is found to be well suited for a wide range of concentration of scatterers. The formalism is also found to be applicable for very high frequencies. The theoretical results obtained by this formalism were compared with experimental findings and the agreement is excellent.
Author (GRA)

N84-15382# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL ELECTROMAGNETICS CODE. METHOD OF MOMENTS. USER'S GUIDE SUPPLEMENT FOR NEC-3 FOR MODELING BURIED WIRES

Gerald J. Burke Oct. 1983 36 p refs
(Contract W-7405-eng-48)
(DE84-002195; UCID-19918) Avail: NTIS HC A03/MF A01

NEC-3 is a version of the Numerical Electromagnetics Code - Method of Moments that has been extended to model wires that are buried or penetrate the ground-air interface. Fields in the presence of an interface are obtained by interpolation or least-squares approximation using tables generated by an auxiliary program SOMNTX which evaluates Sommerfeld integrals. Asymptotic approximations for the field are used at larger distances. This approach is similar to that used in NEC-2 for wires above the interface, but now includes reflected field below the interface and field transmitted across the interface. NEC-3 retains all of the capabilities of NEC-2, and input data for NEC-2 should run with NEC-3 without change. NEC-3 requires about 14 percent more computer memory than NEC-2, however, so it may be worthwhile to retain a copy of NEC-2 for models not involving buried wires. This manual supplements the NEC-2 Users Guide and covers new features of NEC-3 and modifications to old options. The capabilities of NEC-3 and considerations for modeling buried wires are discussed. DOE

N84-15383# Indian Inst. of Science, Bangalore. Centre for Theoretical Studies.
FOURIER OPTICS FOR THE MAXWELL FIELD: FORMALISM AND APPLICATIONS
N. Mukunda (Texas Univ.), R. Simon (American Coll.), and E. C. G. Sudarshan (Texas Univ.) Sep. 1983 30 p refs
(Contract DE-AS05-76ER-03992)
(DE84-002845; DOE/ER-03992/529) Avail: NTIS HC A03/MF A01

The basic formalism for first order paraxial Fourier optics of the Maxwell field was established. Analysis of the relativistic symmetry of Maxwell's equations leads to specific mathematical quantities using those passages from scalar to vector Fourier optics which becomes unambiguous. The inconsistency of viewing scalar Fourier optics as the description of plane polarized Maxwell waves is recognized. System operators giving the actions of lenses, magnifiers, Fourier transformers and general first order systems on Maxwellian waves are constructed. Both field strength and vector potential treatments are given. DOE

N84-15384# Fondazione Ugo Bordoni, Rome (Italy).
[ACTIVITIES REPORT IN COMMUNICATIONS RESEARCH PERFORMED IN COOPERATION WITH HIGHER INSTITUTE FOR POSTS AND TELEGRAPH (ISPT)] Annual Report, 1982 [RELAZIONE SULL'ATTIVITA DI COLLABORAZIONE CON L'I.S.P.T. SVOLTA DALLA FONDAZIONE UGO BORDONI NEL 1982]
Feb. 1983 76 p refs In ITALIAN
Avail: NTIS HC A05/MF A01

Research programs concerning radio communication systems, cable communication systems, digital techniques, automatic management and control of communication systems, laser systems and optoelectronics are summarized. Author (ESA)

N84-15385# Fondazione Ugo Bordoni, Rome (Italy). Lab. di Pontecchio Marconi.
SPREAD SPECTRUM TRANSMISSION. PART 1: GENERAL CHARACTERISTICS [LE TRASMISSIONI A SPETTRO ALLARGATO. PARTE 1: CARATTERISTICHE GENERALI]
Sergio Bonora (Fondazione G. Marconi), Gabriele Falciasecca (Bologna Univ.), and Mario Frullone Dec. 1982 129 p refs In ITALIAN
(FUB-49-1982-PT-1) Avail: NTIS HC A07/MF A01

The design parameters characterizing data transmission techniques are discussed in order to identify the operating conditions favorable to the utilization of spread spectrum modulation. The larger band required may be compensated by the higher data density allowed by lower noise to signal ratios. The problems discussed include interference protection, multiple access, modulation techniques for spread spectrum transmission (such as direct sequence, frequency hopping, time hopping and message modulation), code generators and synchronization. Author (ESA)

N84-15386# Fondazione Ugo Bordoni, Rome (Italy).
THE SMALL TRANSMITTER RECEIVER STATIONS IN THE SIRIO EXPERIMENT [LE PICCOLE STAZIONI RICETRASMITTENTI NELL'ESPERIMENTO SIRIO]
Paolo Lombardi, Piergiorgio Migliorini, and Enrico Saggese (Telespazio S.p.A.) Oct. 1982 12 p In ITALIAN Submitted for publication
(FUB-50-1982) Avail: NTIS HC A02/MF A01

Experiments related to the utilization of 3m antenna transmitter receiver stations are discussed. The stations can transmit or receive via the Sirio satellite either 64 k bit/sec or 2.048 Mbit/sec data rates from or to similar stations or large antenna (17m) stations. System operation was tested using large antenna transmitters and small antenna receivers. With clear sky conditions a 0.0000001 error rate is feasible. The influence of rain events with alternations of the order on up to 12 dB is discussed.
Author (ESA)

N84-15387# Fondazione Ugo Bordoni, Rome (Italy).
STATISTIC PREDICTION TECHNIQUES OF RAIN ATTENUATION STARTING FROM PLUVIOMETRIC STATISTICS [TECNICHE DI PREDIZIONE STATISTICA DELL'ATTENUAZIONE DOVUTA A PIOGGIA A PARTIRE DALLE STATISTICHE PLUVIOMETRICHE]
Francesco Fedi Oct. 1982 11 p refs In ITALIAN Submitted for publication
(FUB-51-1982) Avail: NTIS HC A02/MF A01

A method to predict the statistics of microwave attenuation caused by rain events in ground links or satellite-ground links is presented. The method requires knowledge of the rain intensity which exceeds the annual average by 0.01%. This value in mm/hr substitutes the total annual precipitation in mm which was used up till now to characterize geographic locations. The 0.01% attenuation limit is seen as the product of a specific alternation which is a function of rain parameters and the equivalent link length. The parameters used are the same for large areas, since the same vertical and horizontal rain structure is assumed. The parameter values valid for Italy were determined. Author (ESA)

N84-15388# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
A COMPUTER MODEL FOR AN IMAGING COHERENT LASER RADAR
Dietmar Letalick and Anders Oestberg Sep. 1983 46 p refs
(FOA-C-30341-E; ISSN-0347-3708) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm KR 50

A laser radar model was developed and used to generate simulated laser radar images. The model is useful for understanding how different target/background combinations affect target detection possibilities. It also shows the contrast problem with intensity imaging. The influence of laser system parameters, atmospheric conditions and target and background characteristics can be studied. The generated images can be used in studies of detection algorithms. Natural backgrounds are diffuse as to their surface characteristics. In the model program backgrounds are simulated to give reflected field amplitudes that correspond to actual measured distributions for each background type.
Author (ESA)

N84-15389# Technische Hogeschool, Delft (Netherlands). Afdeling Elektrotechniek.
REFLECTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES AT A ROUGH INTERFACE BETWEEN TWO DIFFERENT MEDIA
P. M. vandenBerg and A. T. deHoop Feb. 1983 40 p refs
(PB83-217588; Rept-1983-01) Avail: NTIS HC A03/MF A01 CSCL 20N

An iterative technique is developed to compute rigorously the electromagnetic wave reflection and transmission at a rough interface between two media. The method is based upon a wave function expansion technique, in which the electromagnetic field equations and the radiation condition are satisfied analytically, while the boundary conditions at the interface are satisfied by an iterative

minimization of the integrated square error in the boundary conditions. In each step of iteration, only Fourier transforms of the spectral and spatial variables occur. As starting value, the Sommerfeld-Weyl plane interface results can be employed.
Author (GRA)

N84-15390# Technische Hogeschool, Delft (Netherlands). Dept. of Electrical Engineering.
DIFFRACTION OF A PLANE ELECTROMAGNETIC WAVE BY AN ELLIPTIC CYLINDER: THE MULTI-ORIGIN TECHNIQUE
G. P. M. Akkermans Feb. 1983 40 p
(PB83-166769; Rept-1982-02) Avail: NTIS HC A03/MF A01 CSCL 20N

The diffraction of a plane electromagnetic wave by a perfectly conducting elliptic cylinder is considered. The scattered field is written as a superposition of wave functions satisfying the Helmholtz equation in circular cylindric coordinates with respect to a number of different origins (Multi-origin representation). Then, the boundary conditions are fulfilled using either a simple point-matching technique or using a least-square-error method. The numerical convergence of these techniques is investigated for a number of different origins. Author (GRA)

N84-15391 Stanford Univ., Calif.
THE SATELLITE APPLICATIONS OF AMPLITUDE COMPANDED SINGLE SIDEBAND MODULATION Ph.D. Thesis
James Warren Mehring 1983 312 p
Avail: Univ. Microfilms Order No. DA8320746

Amplitude Companded Single Sideband or ACSB is a voice processing technique that was originally developed at Stanford University for mobile radio. Previous studies on ACSB for mobile radio have shown a substantial subjective voice improvement for good receive carrier-to-noise ratios. These results for mobile radio indicate that the power and noise figures available on satellite links are sufficient to use ACSB modulation. Single sideband modulation is much more spectrally efficient than currently used modulation techniques and increased channel availability was projected. This study demonstrated that ACSB can be used on satellite links and that its use makes possible an order of magnitude increase in telephone channel availability on existing links. Computer simulation was used to model the ACSB processing to optimize the processing sequence for satellite use and predict performance for voice and voiceband data signals. Dissert. Abstr.

N84-15392 Rensselaer Polytechnic Inst., Troy, N. Y.
DIGITAL COMMUNICATION IN THE PRESENCE OF IMPULSIVE NOISE Ph.D. Thesis
Kwi-Yung Jung 1983 372 p
Avail: Univ. Microfilms Order No. DA8321198

A narrow band, Gaussian-plus-shot noise process has been chosen as an impulsive noise model. The shot noise process has been generalized to control the randomness of arrival of impulses. Some first order statistics, including Amplitude Probability Distribution (APD) and Average Level Crossing Rate (ALCR), have been evaluated through analysis and simulation. The performance of a linear matched filter receiver operating in impulsive noise for various modulation schemes has been extensively studied. The modulation schemes considered include BPSK, QPSK, MSK, DPSK, and BFSK. The results indicate that the performance of a linear receiver can be severely degraded even with a small impulsive noise component. Also, the well known 3 dB advantage of DPSK over BFSK does not necessarily hold in an impulsive noise environment. A variety of numerical techniques for evaluating the probability of error performance of a linear receiver for coherent modulation has been surveyed, and the range of model parameters for which each numerical technique is applicable has been determined. Dissert. Abstr.

N84-15393 New Jersey Inst. of Tech., Newark.
BROADBAND BASE ISOLATED ASYMMETRICALLY FED VHF ANTENNA Ph.D. Thesis
Peter Edward Cunningham 1983 128 p
Avail: Univ. Microfilms Order No. DA8317605

Antennas presently being used for vehicular military VHF communications are narrowband. New generation frequency hopping radios, however, require broadband antennas. The antenna must be base isolated in order to reduce undesirable pattern nulls and impedance variations caused by currents induced on the support structure. Physical constraints limit the antenna length to ten feet while operating from 30 MHz to 88 MHz. To satisfy the above requirements a model of a broadband base isolated, cylindrical antenna less than three meters long was analyzed and built. Equations for the current distribution as a function of the physical parameters were formulated and solved. The antenna selected as most optimum, i.e., maximum gain on the horizon, was 2.5 meters in length and fed 1.0 meters above the mounting surface. The most optimum base isolation network consisted of a coaxial cable choke wound on a ferrite toroid. The cable choke was made resonant at 25 MHz with minimum distributed capacity.
Dissert. Abstr.

N84-15055# Concordia Univ., Montreal (Quebec).
COMPUTER GRAPHICS TECHNIQUES FOR AIRCRAFT EMC ANALYSIS AND DESIGN
S. J. Kubina (Defence Research Estab.) and P. Bhartia *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 9 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15066# Boeing Military Airplane Development, Wichita, Kans.
DESIGN AND VERIFICATION OF ELECTROMAGNETIC COMPATIBILITY IN AIRBORNE WEAPONS SYSTEMS
Wesley R. Johnson *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 6 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15650# SRI International Corp., Menlo Park, Calif.
PROPAGATION EFFECTS IN SATELLITE-BORNE SYNTHETIC APERTURE RADARS
C. L. Rino and V. H. Gonzalez *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p refs (For primary document see N84-15646 06-43)
(Contract DNA001-51-C-0010)
Avail: NTIS HC A17/MF A01

N84-15653# Laboratoire d'Etude des Transmissions Ionospheriques, Cachan (France).
CONTENDING WITH JAMMING IN DECAMETRIC WAVES IN AN ADAPTIVE SYSTEM OF ALL-DIRECTIONAL ANTENNAS [LUTTE CONTRE LE BROUILLAGE EN ONDES DECAMETRIQUES DANS UN SYSTEME D'AERIENS ADAPTIF ORIENTABLE TOUT AZIMUT]
C. Goutelard and A. Joisel *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 14 p refs In FRENCH; ENGLISH summary (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15655# Birmingham Univ. (England). Dept. of Electronic and Electrical Engineering.
A REVIEW OF PROPAGATION AND SCATTERING FACTORS IN REMOTE-SENSING AND SHIP-TRACKING BY HF RADAR
E. D. R. Shearman *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15656# Science Research Council, Chilton (England).
IONOSPHERIC FACTORS AFFECTING THE PERFORMANCE OF HF SKY-WAVE SEA-STATE RADARS
P. A. Bradley, E. N. Bramley, A. J. Gibson, and J. W. King *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 10 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15657# Communications Research Centre, Ottawa (Ontario).
THE CANADIAN PROGRAMME OF EXPERIMENTAL MEASUREMENT OF SEA-STATE CHARACTERISTICS BY SKY-WAVE RADAR
E. L. Winacott, C. Roche (Centre for Cold-Ocean Resources Engineering, St. Johns, Newfoundland), and J. Y. K. Chan (Miller Communications Systems, Ottawa) *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 17 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15658# Naval Ocean Systems Center, San Diego, Calif. Ocean and Atmospheric Sciences Div.
F-REGION VARIABILITY AND HF-PROPAGATION
Adolf K. Paul *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15659# Lowell Univ., Mass. Center for Atmospheric Research.
AUTOMATIC ELECTRON DENSITY PROFILES FROM DIGITAL IONOGRAMS
Bodo W. Reinisch, Robert R. Gamache, and Jane S. Tang *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 11 p refs (For primary document see N84-15646 06-43)
(Contract F19628-80-C-0064)
Avail: NTIS HC A17/MF A01

N84-15660# Hulburt (E. O.) Center for Space Research, Washington, D.C. Ionospheric Effects Branch.
DETERMINATION OF PROPAGATION LIMITATIONS AT HF BY REAL-TIME UPDATE OF A COMPUTER MODEL FROM OBLIQUE SOUNDER DATA
Donald R. Uffelman *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15661# Hulburt (E. O.) Center for Space Research, Washington, D.C. Ionospheric Effects Branch.
ON THE UTILIZATION OF IONOSPHERIC DIAGNOSTICS IN THE SINGLE-SITE LOCATION OF HF EMITTERS
John M. Goodman and Donald R. Uffelman *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15662# General Electric Co., Syracuse, N.Y.
EXTRATERRESTRIAL RADIO NOISE AND ITS EFFECT ON RADAR PERFORMANCE
George H. Millman *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 8 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15663# Royal Norwegian Council for Scientific and Industrial Research, Kjeller. Environmental Surveillance Technology Programme.
MULTIFREQUENCY SCATTERING FOR TARGET CHARACTERIZATION AND IDENTIFICATION: A SUMMARY OF RECENT RESULTS
Dag T. Gjessing *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 8 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15664# Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.
THE EFFECT OF TURBULENT ATMOSPHERE ON BACKSCATTERED WAVES
K. C. Yeh and C. H. Liu *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 6 p refs (For primary document see N84-15646 06-43)
(Grant NSF ATM-82-08931)
Avail: NTIS HC A17/MF A01

N84-15665# TRW Space Technology Labs., Redondo Beach, Calif.
THE NATURE OF MICROWAVE BACKSCATTERING FROM WATER WAVES
S. W. Kwoh and B. M. Lake *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 16 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15666# Laboratoire Central de Telecommunications, Paris (France).
MULTIPLE PATHS ON THE OCEAN SURFACE [TRAJETS MULTIPLES SUR LA SURFACE DE LA MER]
Michel Fournier *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 17 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15667# Racal-Decca Ltd., Chessington (England).
10 cm RADAR GROUND CLUTTER MEASUREMENTS TAKEN FROM A COASTAL STEAMER RADAR ON PASSAGE FROM BERGEN TO NORTH CAPE IN MAY 1982
P. D. L. Williams *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 15 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15668# Segnalamento Marittimo ed Aereo S.p.A., Florence (Italy).
STATISTICAL DATA ON ANOMALOUS PROPAGATION IN THE TYRRHENIAN SEA USING AN X-BAND LINK
V. Sacco, P. P. Lombardini, and G. Marsiglia *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 7 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15669# Marconi Co. Ltd., Great Baddow (England).
A LONG RANGE PROPAGATION EXPERIMENT TO INVESTIGATE THE INCIDENCE OF ANOMALOUS PROPAGATION IN THE NORTH ATLANTIC
G. C. Rider and J. Clarke (Royal Signals and Radar Establishment, Malvern, England) *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-15885 Selenia S.p.A., Rome (Italy). Radar Factory.
OPTIMUM AND SUB-OPTIMUM PROCESSORS FOR MULTISTATIC RADAR SYSTEMS
Egidio dAddio, Alfonso Farina, Maurizio Longo (Naples Univ.), and Ernesto Conte (Naples Univ.) *In its* Riv. Tec. Selenia, Vol. 8, No. 2 1982 p 21-28 refs (For primary document see N84-15882 06-70)
Avail: Issuing Activity

N84-15888 Selenia S.p.A., Rome (Italy). Naval Systems Div.
LOCAL AREA NETWORKS: IMPACT ON SHIPBOARD APPLICATIONS
Gianfranco DalBuono *In its* Riv. Tec. Selenia, Vol. 8, No. 3, 1983 1983 p 1-8 (For primary document see N84-15887 06-70)
Avail: Issuing Activity

N84-15889 Selenia S.p.A., Rome (Italy). Central Development Lab.
A RADAR SIGNAL PROCESSOR IMPLEMENTED WITH SURFACE ACOUSTIC WAVES DEVICES
Tullio Bucciarelli, Alessandro Manuale, Roberto Ronconi, and Giovanni Picardi (Rome Univ.) *In its* Riv. Tec. Selenia, Vol. 8, No. 3, 1983 1983 p 9-14 refs (For primary document see N84-15887 06-70)
Avail: Issuing Activity

N84-15891 Selenia S.p.A., Rome (Italy). Space Div.
THE METEOROLOGICAL DATA DISTRIBUTION MISSION ON BOARD SIRIO SATELLITE
Lamberto Sartini *In its* Riv. Tec. Selenia, Vol. 8, No. 3, 1983 p 25-37 refs (For primary document see N84-15887 06-70)
Avail: Issuing Activity

N84-16039*# Alabama Univ., Huntsville. Dept. of Electronic Engineering Technology.
CHARACTERISTICS OF RF LIGHTNING EMISSION AT 2 GHz AND 250 MHz
Fereydoun Jalali *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 20 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20N

N84-16045*# Berry Coll., Mount Berry, Ga. Dept. of Physics.
A FMCW RADAR RANGING DEVICE FOR THE TELEOPERATOR MANEUVERING SYSTEM
Malcolm W. McDonald *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 15 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 17I

N84-16046*# Tennessee Univ. Space Inst., Tullahoma. Dept. of Electrical Engineering.
THE DEVELOPMENT OF A DIGITAL PROCESSING SYSTEM FOR ACCURATE RANGE DETERMINATIONS
Alfonso Pujol, Jr. *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 13 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 17I

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N84-15394*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF COMPUTER-DESIGNED SMALL-SIZE MULTISTAGE DEPRESSED COLLECTORS FOR A HIGH-PERVEANCE TRAVELING WAVE TUBE
Peter Ramins Jan. 1984 24 p refs
(NASA-TP-2248; E-1700; NAS 1.60:2248) Avail: NTIS HC A02/MF A01 CSCL 09A

Computer designed axisymmetric 2.4-cm-diameter three-, four-, and five-stage depressed collectors were evaluated in conjunction with an octave bandwidth, high-perveance, and high-electronic-efficiency, griddled-gun traveling wave tube (TWT). Spent-beam refocusing was used to condition the beam for optimum entry into the depressed collectors. Both the TWT and multistage depressed collector (MDC) efficiencies were measured, as well as the MDC current, dissipated thermal power, and DC input power distributions, for the TWT operating both at saturation over its bandwidth and over its full dynamic range. Relatively high collector efficiencies were obtained, leading to a very substantial improvement in the overall TWT efficiency. In spite of large fixed TWT body losses (due largely to the 6 to 8 percent beam interception), average overall efficiencies of 45 to 47 percent (for three to five collector stages) were obtained at saturation across the 2.5-, to 5.5-GHz operating band. For operation below saturation the collector efficiencies improved steadily, leading to reasonable (> 20 percent) overall efficiencies as far as 6 dB below saturation. M.G.

N84-15395*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
VIDEO PROCESSOR FOR AIR TRAFFIC CONTROL BEACON SYSTEM Patent Application
Frank Byrne, inventor (to NASA) Filed 28 Sep. 1982 10 p
(NASA-Case-KSC-11155-1; US-Patent-Appl-SN-425201) Avail: NTIS HC A02/MF A01 CSCL 09C

A circuit is disclosed for use in a transponder located in an aircraft or the like for identifying a true side lobe suppression signal being transmitted by a ground located transmitted system. The true side lobe suppression signal includes at least pulses P1 and P2. The circuit causes the transponder to produce a reply signal upon the amplitude of the P1 pulse being a predetermined ratio to said P2 pulse. The circuit includes a pair of transistors with a capacitor connected to the output of the second transistor. The pulses P1 and P2 are supplied to the base electrode of the first transistor. Pulse P1 turns on the two transistors and charges the capacitor to a predetermined level so that when the second pulse P2 arrives, it does not turn on a transistor when it is equal to or less than the first pulse P1. NASA

N84-15396# Naval Research Lab., Washington, D. C. Systems Engineering and Advanced Concepts Branch.
PERFORMANCE CHARACTERISTICS OF PASSIVE COHERENCE ESTIMATORS Interim Report
A. A. Gerlach 31 Aug. 1983 25 p
(XR01405600)
(AD-A133209; AD-E000543; NRL-8729) Avail: NTIS HC A02/MF A01 CSCL 09/4

Two dimensional coherence processing is commonly used for passive detection in acoustic sensor systems. Modern coherence processors, well suited for this purpose, include the magnitude squared coherence (MSC) estimator and the normalized correlation envelope (NCE) estimator. These are biased estimators, whose performance characteristics are not well understood and are exceptionally difficult to analyze. However, by developing a rather unique bias correcting function, the detection performance of biased estimators is derived as a function of both the input signal and the processor parameters, Design parameters, which optimize detection, are determined for both the MSC and the NCE estimators. In applications where the number of degrees of freedom (or time bandwidth product) of a target signal is severely limited, detection performance can be enhanced by signal overcontainment within the processor bandwidth. Performance data are presented in formats appropriate for selecting processor parameters which are optimum for a given application. Practical guidelines are given to avoid misapplying the theoretical results in cases where there are many narrowband interfering signals in the spectral region of a target signal. GRA

N84-15397# California Univ., Livermore. Lawrence Livermore Lab. Chemistry and Materials Science Dept.
BATTERY LIFETIME PREDICTION BY PATTERN RECOGNITION APPLICATION TO LEAD-ACID BATTERY LIFE-CYCLING TEST DATA Interim Report
Sam P. Perone and W. C. Spindler Sep. 1983 39 p Prepared in cooperation with Electric Power Research Inst., Palo Alto, Calif. Submitted for publication
(Contract N00014-82-F-0077; NR Proj. 359-650)
(AD-A133281; TR-4) Avail: NTIS HC A03/MF A01 CSCL 10/3

A novel approach to battery lifetime prediction has been evaluated by application to life-cycling data collected for 108 ESB EV-106. golf cart batteries (tests conducted by TRW for NASA-Lewis). This approach utilized computerized pattern recognition methods to examine initial cycling measurements and classify each battery into one of two classes: long-lived or short-lived. The classifier program was based on either a linear discriminant or nearest neighbor analysis of a training set consisting of: each member of the EV battery set which had failed; the relative lifetime of each member--normalized with respect to test conditions; and a set of features based on measurements of initial behavior. The raw data set included capacity trends over the first 8 or 9 cycles and records of specific gravity and water-added for each cell after

initial cycling. Features defined from these raw data included the individual data items as well as transformations and combinations of these data. All features were represented as standardized variables. It was shown that lifetime prediction of batteries within the two categories defined could be made with about 87% accuracy. It is concluded that for a similarly-manufactured battery set, relative lifetime prediction could be based on initial measurements of the same type examined here. GRA

N84-15398# AiResearch Mfg. Co., Torrance, Calif.
ADVANCED HIGH-POWER GENERATOR FOR AIRBORNE APPLICATIONS Interim Report, Mar. 1981 - Feb. 1982
Andrew R. Druzsba Wright-Patterson AFB, Ohio AFWAL Jun. 1983 198 p
(Contract F33615-80-C-2075; AF Proj. 3145)
(AD-A133290; 82-18823; AFWAL-TR-82-2049) Avail: NTIS HC A09/MF A01 CSCL 10/2

This report summarizes the work accomplished through Phase II of a four-phase program to design and build the stator and housing for a 5-Mw generator and test the complete 5-Mw generator. The PM rotor for this stator and housing is being built under a separate AF companion contract. This work is part of an Air Force exploratory program for high-power airborne electrical power supply technology. Phases I and II encompassed a 10-month period from April 1981 to January 1982. In Phase I, a lightweight, high-power density stator/housing was designed and optimized with computer model BIGMAG for integration with a permanent magnet rotor into a 5-Mw alternator with a specific weight of 0.1 lb/kw or less. Components with potential for significant weight reduction were identified for testing in Phase II. Among these critical components are a novel liquid-cooling scheme for the stator and an elastomer bore seal. Fabrication drawings were prepared for all individual parts of the stator and housing along with a detailed fabrication plan. A plan for testing the complete 5-Mw generator under full-load conditions at the AF Compressor Research Facility also was prepared. Fabrication and testing will be done in Phases III and IV, respectively. Author (GRA)

N84-15399# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UTILIZATION OF LOW TEMPERATURES IN ELECTRICAL MACHINES
Lucyna Kwasniewska-Jankowicz and Zbigniew Mirski 8 Sep. 1983 17 p Transl. into ENGLISH from Wiad. Electrotech. (Poland), v. 48, no. 15(543), 1 Sep. 1980 p 398-401
(AD-A133325; FTD-ID(RS)T-1095-83) Avail: NTIS HC A02/MF A01 CSCL 20/3

The dimensions of conventional and superconducting direct and alternating current generators are compared and the advantages of using superconducting magnets are examined. The critical temperature, critical current, and critical magnetic field intensity of superconductors in an induction winding are discussed as well as the mechanical properties needed for bending connectors at small radii. Investigations of cryogenic cooling, cryostats, thermal insulation and rotary seals are reported as well as results of studies of the mechanical properties of austenitic Cr-Ni steels, welded joints and plastics for insulation. A.R.H.

N84-15400# Notre Dame Univ., Ind. Dept of Electrical Engineering.
ANALOG FAULT DIAGNOSIS OF LARGE-SCALE ELECTRONIC CIRCUITS Final Report, 1 Jun. 1978 - 13 May 1982
Ruey-wen Liu 1 Aug. 1983 166 p
(Contract N00014-78-C-04444)
(AD-A133491) Avail: NTIS HC A08/MF A01 CSCL 14/2

The long-term objective of this research is to develop a practical and reliable Automatic Test Program Generator (ATPG) which will allow us to locate the faulty component(s) of a large analog circuit when it is faulty. The short-term objective is to search for viable and amenable concepts under which long-term objectives can be achieved. During this short period, some significant progress has been made. GRA

N84-15401# Eagle-Picher Co., Joplin, Mo. Electronics Div.
CALCIUM-THIONYL CHLORIDE BATTERY TECHNOLOGY Final Report, Mar. 1982 - May 1983
Tim Potts Wright-Patterson AFB, Ohio AFWAL Jun. 1983 65 p
(Contract F33615-81-C-2076; AF Proj. 3145)
(AD-A133570; AFWAL-TR-83-2049) Avail: NTIS HC A04/MF A01 CSCL 10/2

The purpose of this program segment is to improve the calcium-thionyl chloride technology in order to produce a power cell with an acceptable shelf life. This task involves efforts to further develop a basic understanding of the electrochemical behavior of the cell components. Component stability tests, quality control techniques, cathode optimization studies, and electrochemical research all aid in the determination of the calcium corrosion reaction mechanism. Knowledge of the corrosion mechanisms is a necessary step toward passivating the calcium anode or removing the corrosion causing species. Author (GRA)

N84-15402# Los Alamos Scientific Lab., N. Mex.
FABRICATION OF A HERMETICALLY SEALED CONNECTOR
G. C. Idzorek and L. G. Atencio Oct. 1983 3 p
(Contract W-7405-eng-36)
(DE84-002322; LA-9849-MS) Avail: NTIS HC A02/MF A01

A technique for constructing a vacuum tight ribbon cable bulkhead connector is discussed. Assembling details are given. Minor problems are identified. In over a year of use, no leakage was detected. DOE

N84-15403# Sandia Labs., Albuquerque, N. Mex.
TIME DELAY ESTIMATION USING THE ADAPTIVE DELAY ELEMENT
D. M. Etter (Stanford Univ., Calif.) and R. A. David 1983 4 p refs Presented at Asilomar Conf. on Circuits, Systems and Computers, Pacific Grove, Calif., 31 Oct. 1983
(Contract DE-AC04-76DP-00789)
(DE84-002042; SAND-83-2267C; CONF-8310194-1) Avail: NTIS HC A02/MF A01

The estimation of time delay between two narrowband signals is a common problem in applications such as seismic and acoustical signal processing. A simple real-time adaptive delay element is used to compare delay estimation accuracy for both stationary and nonstationary time delays as well as for varying input signal-to-noise ratios. The comparison includes a modification to the adaptive algorithm which yields a smoothed delay estimate. DOE

N84-15404# Westinghouse Electric Corp., Pittsburgh, Pa.
RECENT ADVANCES IN VARIABLE SPEED ELECTRICAL GENERATOR SYSTEMS FOR LARGE WIND TURBINES
T. S. Andersen, P. S. Hughes, F. F. Klein, and G. A. Mutone 1983 8 p refs Presented at the American Wind Association Natl. Conf. and Wind Expo '83, San Francisco, 17 Oct. 1983
(Contract DE-AC02-81RA-50292)
(DE84-001833; CONF-831093-2) Avail: NTIS HC A02/MF A01

Actual control hardware and software were verified with a hybrid simulation of a full wind turbine system. The controls were combined with power thyristor bridges configured as a cycloconverter and motor-generator test train to implement a variable sped generator and a simulated wind-turbine/drive train. Major features demonstrated include: (1) variable freqency motoring to 50% speed for quick, efficient turbine start-up; (2) synchronization below, at, and above synchronous speeds, both steady state and transient; (3) net power output up to 120 kW with stable response to 50 kW step changes in demand within one second and similarly responsive control of VARs; (4) steady power and VAR output throughout speed transients from ten percent below to ten percent above synchronous speed; (5) output voltage waveform with less than five percent total harmonic distortion; and (6) damping of simulated drive train resonance at 0.2 Hz. DOE

N84-15405# Los Alamos Scientific Lab., N. Mex.
NANOSECOND IMAGE-SHUTTERING STUDIES AT LOS ALAMOS NATIONAL LABORATORY

G. J. Yates, N. S. P. King, S. A. Jaramillo, B. W. Noel, P. L. Gobby, I. Aeby (Edgerton, Germe hausen and Grier, Inc., Goleta, Calif.), and J. L. Detch (Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.) 1983 7 p refs Presented at the Nucl. Sci. Symp., San Francisco, 19 Oct. 1983
(Contract W-7405-eng-36)
(DE84-001733; LA-UR-83-3042; CONF-831015-11) Avail: NTIS HC A02/MF A01

Experimental results comparing gated imaging capabilities of proximity-focused microchannel-plate intensifiers and electrostatically-focused silicon-intensified-target vidicons are presented. Previous response data obtained from several standard and modified versions of both image sensors are summarized. Current efforts on: (1) sector gating of segmented photocathodes; (2) pre-pulsing of photocathodes with infrared light to increase conductivity; and (3) gate pulse injection techniques are discussed. Segmented photocathodes increased gating speed by simultaneous turn-on individual sectors whereas preliminary analyses indicate no improvements from infrared illumination. DOE

N84-15406# Sandia Labs., Albuquerque, N. Mex. Dept. of Electronic and Computer Engineering.
SECOND-ORDER ADAPTIVE INFINITE IMPULSE RESPONSE FILTER
N. Ahmed, D. Hush, G. R. Elliott (SNL), and R. J. Fogler (SNL) 1983 7 p refs Presented at the Asilomar Conf. on Circuits, Systems and Computers, Pacific Grove, Calif., 31 Oct. 1983
(Contract DE-AC04-76DP-00789)
(DE84-001768; SAND-83-2298C; CONF-8310194-2) Avail: NTIS HC A02/MF A01

A second order infinite impulse response (IIR) filter is introduced. An efficient algorithm to use as a line enhancer and tracker is presented. It is demonstrated that it can be used very effectively to enhance and track a single or dominant sinusoid in broadband noise. DOE

N84-15407# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
MICROWAVE TUBES: LITERATURE SURVEY NUMBER 4, COMPRISING THE YEAR 1982
Herbert Steyskal Sep. 1983 166 p refs
(FOA-C-30331-E; ISSN-0347-3708) Avail: NTIS HC A08/MF A01; Research Institute of National Defence, Stockholm KR 50

About 700 articles on microwave generation and amplification are described. Gyrotrons, EBS-tubes, peniotrons, gyrocons and orotrons are covered. Free electron masers and other concepts of generating/amplifying microwave power indicate the state of the art and development trends. Electron guns, cathodes and electron beams up to GW-levels are included. Author (ESA)

N84-15408# Research Inst. of National Defence, Umea (Sweden). Dept. 4.
IMMOBILIZATION OF BIOMOLECULES ON SEMICONDUCTOR SURFACES
Ulf Joensson, Magnus Malmqvist, Hans Nilsson, Goeran Olofsson, and Inger Roennberg Sep. 1983 13 p ref Presented at Biotech 83, London, May 1983
(FOA-C-40178-C2(B2,A3); ISSN-0347-2124) Avail: NTIS HC A02/MF A01

A reproducible, stable and functional introduction of reactive groups on oxide covered silicon surfaces used in chemically sensitive field effect transistors and optical methods based on light reflection is described. Biomolecules, such as antibodies, antigens and enzymes, were covalently attached to the surface modified silicon via a thiol disulfide exchange reaction. The immobilization technique eliminates the risk of crosslinking and homopolymerization, giving monolayer coverage in close contact with the surface. The technique was used for immobilized protein A and interaction of such surfaces with immunoglobulins. The result was evaluated by in situ ellipsometry, which gives the amount of immobilized and interacting material on the surfaces. Author (ESA)

N84-15409# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Abteilung Turbulenzforschung.
PERIODIC FLOW NOISE REDUCTION USING FLOW-EXCITED RESONATORS: THEORY AND APPLICATION
Gary H. Koopmann Apr. 1983 33 p refs Sponsored in part by Houston Univ., Houston, and EPRI, Palo Alto, California
(DFVLR-FB-83-29) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 11

Sound reduction by placing resonators on the cut-off surfaces of centrifugal fans was modeled as an acoustic dipole that results from the interaction of a moving fluid with a solid boundary. Part of the moving boundary is replaced with the fluid entrained in the open mouth surface of the fluid excited resonator. By proper tuning of the resonator, a source can be generated in antiphase to those generated at the remaining solid boundaries, reducing radiated sound. To position the resonator, pressure distribution over the surface of the solid boundary must be known. To tune the resonator for maximum sound reduction, several geometrical parameters can be varied. However, since the choice of the mouth surface area and porosity (hole number and size) is limited by the requirement that the resonator response be made as large as possible, the most straightforward way to tune the resonator is by varying the length of its cavity. Author (ESA)

N84-15410# Technische Hogeschool, Delft (Netherlands). Afdeling Elektrotecniek.
COMPUTATION OF THE TEMPERATURE DISTRIBUTION DUE TO EDDY-CURRENTS IN THE WALL OF A POWER TRANSFORMER
G. Mur Mar. 1983 27 p refs
(PB83-217273; Rept-1983-04) Avail: NTIS HC A03/MF A01 CSCL 09C

Current carrying conductors that are located near the wall of a power transformer may locally cause overheating. A method to avoid this is provided by placing a metal shield between the current carrying conductors and the relevant part of the wall of the transformer. This configuration is analyzed numerically by first computing the electromagnetic field distribution in it and by subsequently computing the resulting temperature distribution. For a typical configuration, numerical results are presented both for the vector potential and for the temperature distribution.
Author (GRA)

N84-15305# National Electrical Engineering Research Inst., Pretoria (South Africa).
INTEGRATED CIRCUIT FAILURE MECHANISM DETECTED BY IMMA
M. Crooke *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 55-61 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15886 Selenia S.p.A., Rome (Italy). Research Dept.
A DIGITAL FERRITE PHASE-SHIFTER FOR HIGH POWER S-BAND OPERATION
Giuseppe Cattarin, Carlo diGregorio, Umberto Parrucci, Fioravante Pucci, and Riccardo Roveda *In its* Riv. Tec. Selenia, Vol. 8, No. 2 1982 p 29-34 refs (For primary document see N84-15882 06-70)
Avail: Issuing Activity

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N84-15411 California Univ., Los Angeles.
BIFURCATIONS IN NONLINEAR PROBLEMS OF HYDRODY-

NAMIC INSTABILITY OF PLANE PARALLEL SHEAR FLOWS Ph.D. Thesis
Masato Nagata 1983 131 p
Avail: Univ. Microfilms Order No. DA8312028

The main goal of this thesis is to contribute towards the understanding of the transition to turbulence. The nonlinear evolution of instabilities occurring in plane parallel shear flows is investigated by following the first few bifurcations. The basic velocity profile described by a cubic polynomial is chosen, since it is an exact solution of the Navier-Stokes equation for a Boussinesq fluid confined between two inclined parallel plates heated from above. The plates are allowed to move in the opposite directions. The instability mechanism becomes purely hydrodynamic by assuming the limit of a small Prandtl number. Two and three dimensional nonlinear steady solutions are obtained numerically by the Galerkin method and the Newton-Raphson iterative method after the solenoidal velocity field is expanded by a truncated series of orthogonal functions. Stability analysis is carried out for the steady solutions by superimposing infinitesimal disturbances with arbitrary three dimensional spatial dependence. The resulting equations for the time growth rate as the eigenvalue are solved numerically. Dissert. Abstr.

N84-15412 Stanford Univ., Calif.
EXPERIMENTAL MIXED CONVECTION HEAT TRANSFER FROM A LARGE VERTICAL SURFACE IN A HORIZONTAL FLOW Ph.D. Thesis
Dennis Lee Siebers 1983 210 p
Avail: Univ. Microfilms Order No. DA8314491

The convection heat transfer and the boundary layer flow on a vertical, 3 m square surface parallel to a horizontal air flow were studied. The heat transfer ranged from forced convection, to mixed convection driven by orthogonal buoyant and inertia forces, to free convection. The emphasis was on mixed convection. Surface temperatures and free stream velocities ranged from 40 to 600 C and 0 to 6.0 m/s, respectively, resulting in Reynolds numbers (Re) and Grashof numbers (Gr) up to 2 x 10 to the 6th power and 2 x 10 to the 12th power, respectively. Dissert. Abstr.

N84-15413 Stanford Univ., Calif.
NUMERICAL SIMULATION OF SEPARATED FLOWS Ph.D. Thesis
Philippe Roland Spalart 1983 177 p
Avail: Univ. Microfilms Order No. DA8314495

The vortex method was used as a basis for a numerical method developed for simulating two-dimensional separated flows. The fluid is incompressible and the Reynolds number is high. A rigorous analytical basis for the representation of the Navier-Stokes equations in terms of the vorticity is used. It includes an equation for the control of circulation around each body. Parasitic numerical effects were controlled. The true physical effects were reproduced coupling an inviscid outer flow (computed by the Vortex Method), with a viscous boundary layer flow (computed by an Eulerian method). Several versions of the method are presented and applied to various problems, most of which had massive separation. The comparison of its results with other results, generally experimental, demonstrates the reliability and the general accuracy of the new method, with little dependence on empirical parameters. Many of the complex features of the flow past a circular cylinder, over a wide range of Reynolds numbers, are correctly reproduced. Dissert. Abstr.

N84-15414 Rochester Univ., N. Y.
AN EXPERIMENTAL INVESTIGATION OF THE BOUNDARY LAYER STRUCTURES IN A PARTIALLY-FILLED HORIZONTAL AND RAPIDLY-ROTATING CYLINDER Ph.D. Thesis
Timothy Joseph Singler 1983 265 p
Avail: Univ. Microfilms Order No. DA8321699

The flow in a partially filled right circular cylinder rotating about its symmetry axis which was carefully aligned to be perpendicular to gravity was investigated. The cylinder rotates sufficiently rapidly so that the flow is centrifugally dominated and the heavier liquid is held against the cylinder walls forming an almost solid body rotation about a buoyant circular core. Two variations of the partially filled cylinder were studied: the free surface case in which the cylinder is partially filled with liquid and the remaining volume is air, and the rigid surface case in which a plastic circular flat is inserted and the remaining cylinder volume is filled with liquid. Endwall velocity data for the free surface showed very good agreement with theory in the Ekman layer but departed from theory in the interior, sidewall velocity data for the rigid surface showed qualitatively the same behavior but showed a greater disparity with theory in the interior. Free surface sidewall velocity data showed good qualitative agreement with predictions in the interior but departed sharply with theory near the core interface. Nonmonotonic behavior of the azimuthal velocity in the Ekman layer for the rigid surface led to the postulation of a Rayleigh type instability mechanism for the flow. Dissert. Abstr.

N84-15415 Stanford Univ., Calif.
AN EXPERIMENTAL INVESTIGATION OF THE STRUCTURE OF A TURBULENT REATTACHING FLOW BEHIND A BACKWARD-FACING STEP Ph.D. Thesis
Stephen William Pronchick 1983 172 p
Avail: Univ. Microfilms Order No. DA8320765

The structure of a turbulent reattaching flow behind a backward-facing step was studied experimentally in a low-velocity water channel, in order to observe the physical structure of the flow and to better understand the relation between this physical structure and measured turbulence quantities. Flow visualization using the hydrogen bubble technique was used to observe the physical structure of the flow. The flow structure in the reattachment region is dominated by large three dimensional eddies generated in the free shear layer. The eddies have a wide distribution in size, and their trajectories exhibit a wide dispersion. As they pass through the reattachment zone, these structures follow one of two major paths: (1) they either interact strongly with the wall, resulting in a loss of large-scale coherence and the generation of backflow, or (2) they pass through the reattachment zone with little interaction or loss of coherence. Path (1) has three subpaths, resulting in four typical fluid paths. Dissert. Abstr.

N84-15416 Oregon State System of Higher Education, Monmouth.
THE STRUCTURE OF TURBULENT ENTRAINING FLOW IN AN ANNULUS WITH A ROTATING SCREEN Ph.D. Thesis
Soon-Chang Yoon 1983 86 p
Avail: Univ. Microfilms Order No. DA8320437

Experiments on mixed-layer growth in an annulus with rotating screen are analyzed. Horizontal and vertical profiles of the mean velocities and turbulent intensities are obtained from velocity measurements with hot-film anemometer. When the rotating screen covers the entire horizontal area, as in conventional annulus experiments, it was found that a turbulent Ekman layer of thickness two tenths of the typical mixed-layer depth exists just below the rotating screen; its termination prohibits the downward transport of the externally applied surface stress to the rest of the mixed layer. The measured turbulent intensities in a narrow region near the outer wall are an order of magnitude greater than those in the central region. A large secondary circulation is found to be important to the momentum transfer in the mixed layer. The mean flow is found to be stable inertially in most of the annulus area except in the narrow region near the outer wall.
Dissert. Abstr.

N84-15417 Pennsylvania State Univ., University Park.
COMPARISON OF STEADY STATE TRANSITIONS IN TRUNCATED SPECTRAL AND FINITE DIFFERENCE MODELS OF TWO-DIMENSIONAL SHALLOW CONVECTION Ph.D. Thesis
Hai-Ru Chang 1983 189 p
Avail: Univ. Microfilms Order No. DA8320872

Concurrent use of both low-order spectra and highly accurate grid-point models is shown to provide an efficient and effective means for studying nonlinear hydrodynamic processes in two-

dimensional shallow convection. Analytical, steady solutions obtained from a low-order spectral model provided qualitatively important branching information about the solutions of the original systems. This information was used to guide design of the finite differencing schemes or the grid-point model. On the other hand, the numerical solutions obtained from the grid-point model were used to determine the qualitative accuracy of a particular low-order truncation for the spectral model. Through this interaction process, it is shown that highly accurate finite difference schemes are required for the grid-point model in order that the transition process can be simulated correctly. Dissert. Abstr.

N84-15418 Georgia Inst. of Tech., Atlanta.
COMPUTATION OF STEADY INTERNAL FLOWS USING INTEGRAL REPRESENTATION METHODS WITH FINITE SERIES EXPANSIONS Ph.D. Thesis
Clin Mao-Bo Wang 1983 143 p
Avail: Univ. Microfilms Order No. DA8322564

The integral representations recast from the two dimensional Navier-Stokes and continuity equations are used to compute the steady viscous internal flow problems. The vorticity and the velocities are utilized as the dependent variables. The application of finite series expansions to these integral relations gives a rapid, iterative, explicit numerical calculation procedure. The vorticity boundary condition was treated properly by using the integral relations. This condition appears as a constraint equation imposed on the vorticity field in an integral form. The conservative theorems of mass and vorticity for the flow field are satisfied globally. Solutions are sought both on circular and square domains for various Reynolds numbers. The finite Fourier series and Chebyshev polynomial expansions are employed in conjunction with the integral relations for circular and square domain respectively. Several flow problems are studied on the mesh systems with different grid size in order to test the accuracy and the convergence of the numerical solutions. Dissert. Abstr.

N84-15419 Michigan Univ., Ann Arbor.
DESIGN, CONSTRUCTION, AND USE OF A HIGH-RESOLUTION, TWO-COMPONENT LDA Ph.D. Thesis
Jesus Jose Velazquez-Saavedra 1983 94 p
Avail: Univ. Microfilms Order No. DA8324123

The study of wall bound turbulent flows at high Reynolds numbers has shown that the scale of turbulence near the wall, is too small to allow accurate velocity measurements with conventional instrumentation. The objective of this study was to advance the use of Laser-Doppler anemometry, LDA, in the investigation of small scale turbulent structure. In order to resolve this structure in the region near the wall, a LDA system with a high-resolution is necessary. In this investigation, a novel LDA system was designed, constructed, and placed in operation. This system had a measurement volume of approx. 40 micrometers or about two viscous lengths. This small size of the measurement volume was produced by a wide angle for two of the incident beams (60 degrees), and by collecting the scattered radiation partially in the side scatter mode. Measurements were performed in a fully developed turbulent water channel, seeded with TiO2 particles, and data were obtained at a rate of approx. 2000 per sec., and stored in digital form with the aid of a computer. Dissert. Abstr.

N84-15420 Georgia Inst. of Tech., Atlanta.
AN ASSUMED DEVIATORIC STRESS-VELOCITY-PRESSURE MIXED FINITE ELEMENT METHOD FOR UNSTEADY CONVECTIVE, INCOMPRESSIBLE VISCOUS FLOW Ph.D. Thesis
Chien-Tung Yang 1983 188 p
Avail: Univ. Microfilms Order No. DA8322567

The formulation of a mixed finite element method for the analysis of unsteady, convective, incompressible viscous flow is presented, in which: (1) the deviatoric stress, pressure, and velocity are discretized in each element; (2) the deviatoric stress and pressure are subject to the constraint of the homogeneous momentum balance condition in each element, a priori; (3) the convective acceleration is treated by the conventional Galerkin approach; (4) the finite element system of equations involves only the constant term of the pressure field (which can otherwise be an arbitarary polynomial) in each element, in addition to the nodal velocities; and (5) all integrations are performed by the necessary order quadrature rules. A fundamental analysis of the stability of the numerical scheme is presented. Methods of solution of the unsymmetric nonlinear equations for steady flow and the first order time dependent differential equations for the unsteady flow and the first order time dependent differential equations for the unsteady flow are discussed at length. This mixed formulation is easily applicable to three dimensional problems. However, solutions to several problems of two dimensional Navier-Stokes flow.
Dissert. Abstr.

N84-15421 Michigan Univ., Ann Arbor.
PLASTIC FLOWS OF TUBES AND BLOCKS Ph.D. Thesis
Jong Soo Lee 1983 104 p
Avail: Univ. Microfilms Order No. DA8324227

Expansion of thick walled tubes and compression of rectangular blocks to produce plastic deformations in them are treated as flow problems. These plastic flows are analyzed by a variational formulation of the limit analysis. To treat realistically the contact condition in the both cases, the hydrostatic pressure distribution and the friction effect were studied. The expansion is accomplished by forcing a mandrel through the tube. A frictional contact condition is assumed. Mandrel profile is optimized among a class of shapes including spheres, cones and paraboloids for the least forming pressure. A specific paraboloid is found to be optimal for a given set of geometric and friction conditions. The block compression is also analyzed with a realistic contact condition. The effects of friction and aspect ratio of the block are studied. A critical coefficient is found for each aspect ratio of the block. Numerical results are presented for a wide range of parameter variation. These results provide new interpretations for some experimental phenomena understood before only from an empirical point of view. Dissert. Abstr.

N84-15422 Illinois Univ., Urbana-Champaign.
STUDIES IN UNSTEADY PENETRATIVE THERMAL CONVECTION Ph.D. Thesis
Ranganathan Kumar 1983 165 p
Avail: Univ. Microfilms Order No. DA8324590

The dynamics and structure of turbulence in the interfacial region and the upper part of a mixed layer which is capped by a linearly stratified, nonturbulent region are studied. Measurements of the local, instantaneous values of the temperature, the vertical velocity and horizontal velocity were made using a thermocouple and a two component dual beam laser Doppler velocimeter. Vertical profiles of all relevant one point moment including joint temperature velocity moments up to fourth order were obtained. Mean temperature measurements were made for various kinematic heat flux settings to understand the thermal structure in the entrainment zone. Conditional averaging techniques and probability density functions were employed to infer the properties of fluid elements in the mixed layer. A length scale in the interfacial layer, based on the temperature gradient in the stable region is proposed. Power spectra for velocity and temperature were analyzed to check the possible existence of inertial subrange and estimate the noise level. With the aid of flow visualization, a phenomenonological model of penetrative convection for low entrainment rate was developed. Dissert. Abstr.

N84-15423 Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
EVALUATION OF AIR-COOLED CENTRAL RECEIVERS
J. D. Wright Dec. 1982 8 p refs Presented at the ASME Solar Energy Div. 6th Ann. Tech. Conf., Orlando, Fla., 19-21 Apr. 1983 (Contract DE-AC02-77CH-00178)
(DE83-005130; SERI/TP-252-1775; CONF-830405-5) Avail: NTIS HC A02/MF A01

Air cooled central receivers with metal tube absorbers which are not competitive with other central receiver technologies are discussed. The cost of electricity produced by an air receiver operating at approximately 8150C coupled to a Brayton or

combined cycle is 20 to 30% higher than that produced by draw salt or steam receivers coupled to steam Rankine power cycles. Similar results are found in cogeneration and industrial process heat applications. The higher cost and disadvantages of metal tube air cooled receivers stem directly from the poor heat transfer characteristics of air and from the expensive metals required to fabricate the absorber tubes. Some of the requirements for higher temperature receivers to produce hot air are defined. DOE

N84-15424# Institute of Space and Astronautical Science, Tokyo (Japan).
FLOW VISUALIZATION AND LDV MEASUREMENT OF TURBULENT MIXING LAYERS
Osamu Inoue, Shun-itsu Sato, and Hakuro Oguchi Sep. 1983 18 p refs
(Rept-606; ISSN-0285-6808) Avail: NTIS HC A02/MF A01

Structures of the turbulent mixing layers are experimentally investigated with special regard to its dependence on forced initial disturbances. The mixing layers are produced by setting a model screen perpendicular to the freestream at a test section. Initial disturbances are forcibly imposed by equipping with various sizes of a thin rod along the edge of the model screen or at the origin of the mixing layer. Flow features are observed by visualization technique by means of the smoke-wire method. Statistical quantities are measured by laser-Doppler velocimeter. Three kinds of model geometry are dealt with these are of one-edge type, belt type, and circular disk type. The flows produce by these model screens represent, respectively, a plane mixing layer and two-dimensional and axisymmetric jets issuing into ambient stream of higher velocity. Flow visualization results indicate that the two-dimensionality of large-scale coherent structures seems to persist in high-turbulent flows, although comparatively smaller scale vortices are superimposed over the flow field within the mixing layer. The mixing layers are in self-preserving state, at least, up to third order moments, but in no universal state. The growth rates of the mixing layer are shown to strongly depend on the initial disturbance imposed.
Author

N84-15425*# Science Applications, Inc., Princeton, N.J. Propulsion Gas Dynamics Div.
FULLY-COUPLED ANALYSIS OF JET MIXING PROBLEMS. PART 1. SHOCK-CAPTURING MODEL, SCIPVIS
Sanford M. Dash and David E. Wolf Jan. 1984 135 p refs
(Contract NAS1-16535)
(NASA-CR-3761; NAS 1.26:3761; SAI/PR-TR-13) Avail: NTIS HC A07/MF A01 CSCL 20D

A computational model, SCIPVIS, is described which predicts the multiple cell shock structure in imperfectly expanded, turbulent, axisymmetric jets. The model spatially integrates the parabolized Navier-Stokes jet mixing equations using a shock-capturing approach in supersonic flow regions and a pressure-split approximation in subsonic flow regions. The regions are coupled using a viscous-characteristic procedure. Turbulence processes are represented via the solution of compressibility-corrected two-equation turbulence models. The formation of Mach discs in the jet and the interactive analysis of the wake-like mixing process occurring behind Mach discs is handled in a rigorous manner. Calculations are presented exhibiting the fundamental interactive processes occurring in supersonic jets and the model is assessed via comparisons with detailed laboratory data for a variety of under- and overexpanded jets. M.G.

N84-15426*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THERMAL ANALYSIS RESEARCH APPLICABLE TO SPACE STATION TECHNOLOGY NEEDS
Howard M. Adelman Apr. 1983 53 p Presented at the Space State Technol. Workshop, Williamsburg, Va., 28-31 Mar. 1983
(NASA-TM-84658; NAS 1.15:84658) Avail: NTIS HC A04/MF A01 CSCL 20D

Thermal analysis, optimization, and software research and development at the NASA Langley Research Center which is applicable to analytical design calculations for space station structures are summarized. Topics discussed include integrated thermal-structural software, improved thermal radiation analysis, solution techniques for transient temperatures, unified thermal-structural finite elements, thermal structural sensitivity analysis and optimization, and concept and performance analysis for heat pipes.
Author

N84-15427*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LIQUID MANAGEMENT IN LOW GRAVITY USING BAFFLED ROTATING CONTAINERS
Robert F. Gans Jan. 1984 24 p refs
(NASA-TP-2263; NAS 1.60:2263) Avail: NTIS HC A02/MF A01 CSCL 20D

Possible static configurations of liquids in rotating cylindrical containers with baffles evenly spaced in the axial direction are found. The force balance is among surface tension, centrifugal force and gravity. Two instabilities are found in this parameter space: type 1 is the inability of the liquid to form an interface attached to the baffles; type 2 is the inability for multi-baffled configurations to sustain interfaces between each pair of baffles. The type 1 analysis is confirmed through laboratory based equipment. Applications to orbiting containers are discussed.
Author

N84-15428*# Rocketdyne, Canoga Park, Calif. Advanced Combustion Devices.
ATOMIZATION AND MIXING STUDY Interim Report
Allan Ferrenberg and V. W. Jaqua 27 Jul. 1983 190 p refs
(Contract NAS8-34504)
(NASA-CR-170943; NAS 1.26:170943; RI/RD83-170) Avail: NTIS HC A09/MF A01 CSCL 20D

The state of the art in atomization and mixing for triplet, pentad, and coaxial injectors is described. Injectors that are applicable for LOX/hydrocarbon propellants and main chamber and fuel rich preburner/gas generator mixture ratios are of special interest. Various applicable correlating equations and parameters as well as test data found in the literature are presented. The validity, utility, and important aspects of these data and correlations are discussed and the measurement techniques used are evaluated. Propellant mixing tests performed are described and summarized, results are reported, and tentative conclusions are included.
A.R.H.

N84-15429# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS
1983 468 p refs Proc. of Lecture Series, Rhode Saint Genese, Belgium, 24-28 Jan. 1983
(VKI-LS-1983-01) Avail: NTIS HC A20/MF A01

Equations of fluid flow, finite difference approximations and basic mathematical properties of each; numerical methods for the Euler equations; finite difference methods for convective-diffusive equations; a finite difference technique for laminar and turbulent compressible boundary layers; finite difference approximations of the Navier-Stokes equations for incompressible flows; iterative techniques for elliptic finite difference equations; iterative solution of the finite difference potential equations for subsonic and transonic flows; and finite element methods for potential flows were discussed. For individual titles, see N84-15430 through N84-15437.

N84-15430# Reading Univ. (England).
EQUATIONS OF FLUID FLOW, FINITE DIFFERENCE APPROXIMATIONS AND BASIC MATHEMATICAL PROPERTIES OF EACH
K. W. Morton *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluid Dyn. 1983 70 p refs (For primary document see N84-15429 06-34)
Avail: NTIS HC A20/MF A01

Fluid flow equations and their approximation by finite differences, including advection equations, compressible Euler equations, potential flow, and incompressible Navier-Stokes equations

are introduced. Stability analysis of finite difference methods for initial boundary value problems is outlined. Finite element methods for simple steady flows and for unsteady flows are presented. Moving finite element methods are sketched. Author (ESA)

N84-15431# Royal Aircraft Establishment, Bedford (England).
AN INTRODUCTION TO NUMERICAL METHODS SUITABLE FOR THE EULER EQUATIONS
P. L. Roe *In* Von Karman Inst. for Fluid Dynamics. Introduction to Computational Fluid Dyn. 1983 113 p refs (For primary document see N84-15429 06-34)
Avail: NTIS HC A20/MF A01

The significance of the conservation form for Euler equations is discussed and the application of vector concepts, characteristic methods, shock fitting methods and finite element methods is introduced. Marching schemes for linear, scalar problems, and nonlinear aspects are considered. Two and three dimensional problems; computations on a curvilinear grid; and boundary conditions are covered. Artificial viscosity and entropy; and convergence to steady state are presented. Author (ESA)

N84-15432# Liege Univ. (Belgium).
FINITE DIFFERENCE METHODS FOR CONVECTIVE-DIFFUSIVE EQUATIONS
Y. Adam *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluid Dyn. 1983 36 p refs (For primary document see N84-15429 06-34)
Avail: NTIS HC A20/MF A01

Methods for the integration of the heat equation describing temperature evolution in a homogeneous one dimensional solid body are extended to the resolution of general convective-diffusive equations. For two-dimensional problems, alternating direction implicit methods are introduced. Locally one dimensional methods are described. When the cell Reynolds number in advective-diffusive equations is > 2, the modeled equation differs from the original. Second order centered differencing with no artificial diffusion gives a physically meaningless solution spoiled by oscillations. Upwind differencing can be applied, giving another equation to solve. Solutions to this dilemma are discussed.
Author (ESA)

N84-15433# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A FINITE DIFFERENCE TECHNIQUE FOR LAMINAR AND TURBULENT COMPRESSIBLE BOUNDARY LAYERS
R. Arina and J. A. Essers *In its* Introduction to Computational Fluid Dyn. 1983 56 p refs (For primary document see N84-15429 06-34)
Avail: NTIS HC A20/MF A01

A technique for two dimensional and axisymmetric steady compressible boundary layer flow calculations is described. The method is used for flow regions ranging from incompressible to strongly supersonic outer flows. It can be generalized to other shear flows such as free jets, wall jets, wakes and duct flows. Calculations were performed for laminar flows, but results obtained using a simple mixing length model are also presented.
Author (ESA)

N84-15434# Technische Hochschule, Aachen (West Germany).
FINITE-DIFFERENCE APPROXIMATIONS OF THE NAVIER-STOKES EQUATIONS FOR INCOMPRESSIBLE FLOWS
Egon Krause *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluids Dyn. 1983 47 p refs (For primary document see N84-15429 06-34)
Avail: NTIS HC A20/MF A01

Numerical solutions of the Navier-Stokes equations for incompressible unsteady two and three dimensional viscous flows are introduced. The differential formulations of the continuity equation and of the momentum equations are derived from the integral relations for mass conservation and momentum balance. The energy fluxes and the energy equation are described. The vorticity transport equation with the Poisson equation for the stream function and the pressure; the Poisson equations for the velocity components for two dimensional flow related to the gradients of the vorticity component; the fourth order equation for the stream function of two dimensional flow; and the divergence form of the equations of motion are obtained. Author (ESA)

N84-15435# Ghent Univ. (Belgium). Dept. of Machinery.
ITERATIVE TECHNIQUES FOR THE SOLUTION OF ELLIPTIC FINITE DIFFERENCE EQUATIONS
E. Dick *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluid Dyn. 1983 41 p refs (For primary document see N84-15429 06-34)
Avail: NTIS HC A20/MF A01

Iterative techniques for solving linear, positive finite difference equations with boundary conditions not all of Neumann type are outlined. The Jacobi and Gauss-Seidel methods are explained. Successive overrelaxation, block iterative, and alternating direction iterative methods are described. The approximate factorization method, and conjugate gradient method are introduced. Iterative methods for nonsymmetric, nonlinear and nonpositive equations are mentioned. Author (ESA)

N84-15436# Ghent Univ. (Belgium). Dept. of Machinery.
ITERATIVE SOLUTION OF THE FINITE DIFFERENCE POTENTIAL EQUATIONS FOR SUBSONIC AND TRANSONIC FLOWS
E. Dick *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluid Dyn. 1983 24 p refs (For primary document see N84-15429 06-34)
Avail: NTIS HC A20/MF A01

The potential equations for isentropic flow of a perfect gas with uniform upstream conditions are introduced, and elliptic finite differece discretizations are outlined. The time dependent analogy successive overrelaxation, and approximate factorization techniques are presented. Author (ESA)

N84-15437# Vrije Universiteit, Brussels (Belgium).
FINITE ELEMENT METHODS FOR POTENTIAL FLOWS
Ch. Hirsch *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluid Dyn. 1983 67 p refs (For primary document see N84-15429 06-34)
Avail: NTIS HC A20/MF A01

The computational steps of the finite element method are recalled, and applications to the elliptic subsonic case are described. Iterative methods, such as successive overrelaxation and alternating direction iteration, are compared with finite difference solutions for transonic flows. Convergence acceleration techniques, such as the multigrid method, applied to an arbitrary finite element mesh are outlined. Author (ESA)

N84-15438# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
UNCONFINED GAS EXPLOSIONS
1983 341 p refs Proc. of Lecture Series, Rhode Saint Genese, Belgium, 7-11 Feb. 1983
(VKI-LS-1983-02) Avail: NTIS HC A15/MF A01

Unconfined vapor cloud explosions theories and experiments; accident analysis; flat cloud modeling; estimating blast wave properties; analytical solutions for the flow field induced by a spherical flame expanding at constant velocity; flow fields induced by unconfined spherical accelerating flames; characterization of the pressure wave originating in the explosion of a gas cloud; and interaction of gas explosions with buildings were discussed. For individual titles, see N84-15439 through N84-15447.

N84-15439# Technology and Management Systems, Inc., Burlington, Mass.
UNCONFINED VAPOR CLOUD EXPLOSIONS: A REVIEW OF RECENT THEORIES AND EXPERIMENTS
Phani K. Raj *In* Von Karman Inst. for Fluid Dynamics Unconfined Gas Explosions 1983 67 p refs (For primary document see N84-15438 06-34)
Avail: NTIS HC A15/MF A01

The theory of premixed vapor combustion and gas detonations

is discussed. Conditions under which detonation waves can be initiated and sustained in unconfined clouds are indicated. Detonability limits of various gas mixtures in different geometries are outlined. Nonideal explosion phenomena are reviewed. Tests to study the detonability of fuel-oxident mixtures in unconfined geometries, including large balloon tests conducted with explosive initiators and detonation wave (from a pipe) initiators are described. Tests involving passive ignition of large vapor clouds in the open and vapor clouds in semiconfined situations are summarized. Tests to determine the effect on turbulent flame propagation speeds due to obstacles in the flame path are also reviewed.
Author (ESA)

N84-15440# Battelle Inst., Frankfurt am Main (West Germany).
IDENTIFICATION OF PROBLEM AREAS
W. Geiger and M. Stock *In* Von Karman Inst. for Fluid Dynamics Unconfined Gas Explosions 1983 36 p refs (For primary document see N84-15438 06-34)
Avail: NTIS HC A15/MF A01

The formation of explosive gas clouds, their detonation, and subsequent flame propagation and pressure wave generation are discussed. Hazard potential for unprotected persons, pressure load on structures, and structural response are summarized.
Author (ESA)

N84-15441# Battelle Inst., Frankfurt am Main (West Germany).
PRACTICAL APPROACHES IN ACCIDENT ANALYSIS
M. Stock *In* Von Karman Inst. for Fluid Dynamics Unconfined Gas Explosions 1983 23 p refs (For primary document see N84-15438 06-34)
Avail: NTIS HC A15/MF A01

An accident analysis technique based on successive application of structural response, explosion dynamics, gas cloud formation, and plant operation failure mode models is proposed. The method takes into account the nonideal explosion characteristic of a deflagration in the unconfined cloud. The resulting pressure wave differs significantly from a shock wave and the response of structures like lamp posts and walls can differ correspondingly. This gives a more realistic insight into explosion courses than a simple TNT-equivalent approach.
Author (ESA)

N84-15442# Battelle Inst., Frankfurt am Main (West Germany).
FLAT CLOUD MODELING
W. Geiger *In* Von Karman Inst. for Fluid Dynamics Unconfined Gas Explosions 1983 30 p refs (For primary document see N84-15438 06-34)
Avail: NTIS HC A15/MF A01

Models for detonation and deflagration of flat vapor clouds in ideal situations are reviewed. An ideal situation is defined as pancake-shaped quiescent cloud (constant thickness, circular); homogeneous mixture; flat, unobstructed terrain; and central ignition. Nonideal features of real situations which are neglected in the models are discussed qualitatively. Analytical and numerical detonation models are described. Acoustic, and piston deflagration models are compared. Acoustic models tend to underestimate overpressure in the near field; the piston model agrees reasonably well with experimental data.
Author (ESA)

N84-15443# Prins Maurits Lab. TNO, Rijswijk (Netherlands).
ESTIMATE OF BLAST WAVE PROPERTIES
J. P. Zeeuwen *In* Von Karman Inst. for Fluid Dynamics Unconfined Gas Explosions 1983 10 p refs (For primary document see N84-15438 06-34)
Avail: NTIS HC A15/MF A01

Correlation and TNT-equivalent models for UVCE blast wave properties are reviewed, and a model which estimates blast parameters from information on the cloud and its location and uses these parameters to evaluate damage is presented. The prediction model is based on calculations for an ideal, homogeneous, hemispherical, centrally ignited vapor cloud. In case of a deflagration an energy release rate function, equivalent to a certain flame path, is assumed. The results of these calculations (peak pressures as a function of distance) are used together with data for a detonating cloud. The positive phase duration is derived from separate calculations. The method estimates maximum effect, and it is not possible to predict when little or no blast will be generated.
Author (ESA)

N84-15444# Prins Maurits Lab. TNO, Rijswijk (Netherlands).
VAPOR CLOUD EXPLOSION EXPERIMENTS
J. P. Zeeuwen *In* Von Karman Inst. for Fluid Dynamics Unconfined Gas Explosions 1983 16 p refs (For primary document see N84-15438 06-34)
Avail: NTIS HC A15/MF A01

Experiments on vapor cloud detonation and deflagration are summarized. The literature shows that although detonations are possible in vapor clouds, the probability is low because of the high initiation energy and the limiting factors such as minimum cloud height. Factors causing acceleration of a deflagration are identified.
Author (ESA)

N84-15445# Poitiers Univ. (France). Lab. d'Energetique et de Detonique.
ANALYTICAL SOLUTIONS FOR THE FLOW FIELD INDUCED BY A SPHERICAL FLAME EXPANDING AT CONSTANT VELOCITY
B. Deshaies *In* Von Karman Inst. for Fluid Dynamics Unconfined Gas Explosions 1983 38 p refs (For primary document see N84-15438 06-34)
Avail: NTIS HC A15/MF A01

An analytical solution for predicting blast effects of explosions in deflagration regimes is outlined. The analysis gives explicit algebraic solutions (closed form solutions) for the whole flow field, provided that the spherical flame is expanding at constant velocity and that burned gases are at rest. Solutions are first obtained using matched asymptotic expansion for flame expanding at a low Mach number. Then, for larger values of the flame Mach number, solutions are obtained using a simplified mathematical formulation of the problem, derived from the exact one using assumptions based on the behavior of the numerical solution for high Mach number flames. These two set of solutions give a complete description of the whole flow field (pressure, velocity, maximum pressure effect, Mach number of the leading shock wave) in terms of the expansion ratio and Mach number of the flame front.
Author (ESA)

N84-15446# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CHARACTERIZATION OF THE PRESSURE WAVE ORIGINATING IN THE EXPLOSION OF A GAS CLOUD
J. A. Essers *In its* Unconfined Gas Explosions 1983 67 p refs Sponsored by Commission of European Communities (For primary document see N84-15438 06-34)
Avail: NTIS HC A15/MF A01

Models for predicting the effects of hydrocarbon explosions on nuclear power plants are discussed. By solving the Euler equations for simple one dimensional models, formulas predicting wave speed, induced flow velocity, reflected wave speed and overpressure as functions of the local value of incident wave overpressure are obtained. A simplified nonlinear isentropic potential flow model is proposed. Errors in predicting wave characteristics from this model or from classical linear acoustic models are evaluated. Formulas to predict the evolution of main pressure pulse characteristics are given. The time and distance required for the formation of a sharp pressure pulse and to obtain a significant spreading of expansion phase is assessed. The ability of models to accurately predict these deformations is discussed. The isentropic model leads to an excellent prediction of all wave characteristics if the overpressure is not very large. Except for very weak overpressures, the accuracy of acoustic models is poor.
Author (ESA)

N84-15447# Prins Maurits Lab. TNO, Rijswijk (Netherlands).
INTERACTION OF GAS EXPLOSIONS WITH BUILDINGS
A. Harmanny *In* Von Karman Inst. for Fluid Dynamics Unconfined Gas Explosions 1983 21 p refs (For primary document see

N84-15438 06-34)
Avail: NTIS HC A15/MF A01

Properties of blast waves are summarized, and interaction of blast waves with structures is described. Response of structures to dynamic loading is discussed. Elastic behavior (dynamic load factor) and elastoplastic behavior (ductility factor) are recalled. The role of buckling as a magnification factor is sketched. Material behavior under high rates of loading is considered. Author (ESA)

N84-15448# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENT SHEAR FLOWS
1983 528 p refs Proc. of Lecture Series, Rhode Saint Genese, Belgium, 28 Feb.- 4 Mar. 1983
(VKI-LS-1983-03) Avail: NTIS HC A23/MF A01

Experimental techniques for free edges of turbulent flows; asymmetric turbulent flows; the core region of channel flows; eddy detection within turbulent shear flows; bursting in bounded shear flows; large scale motion in turbulent boundary layers; two dimensional compressible turbulent boundary layers; effects of unsteadiness on turbulent boundary layers; three dimensional wake of a swept wing; three dimensional turbulent boundary layers; and three dimensional turbulent boundary layers in turbomachines were discussed. For individual titles, see N84-15449 through N84-15460.

N84-15449# Imperial Coll. of Science and Technology, London (England).
INTRODUCTION TO TURBULENT SHEAR FLOWS
Phillip Ligrani, M. *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 44 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Classification of turbulent shear flows, equations governing fluid motions, and eddy viscosity closure models of turbulence are discussed. Flow visualization, hot-wire anemometry, laser Doppler velocimetry, and conditional sampling techniques are described. Wall flow measurement is considered. Author (ESA)

N84-15450# Ecole Centrale de Lyon (France).
EXPERIMENTAL TECHNIQUES FOR FREE EDGES OF TURBULENT FLOWS
G. Comte-Bellot and R. Morel *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 32 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Statistical properties for investigating free turbulent edges; detection of turbulent status; and flow visualization and image processing are discussed. Vorticity metering, laser Doppler velocimetry, and thermal and other scalar tagging are described. Enhancement of signal discriminatory capability, smoothing indicator signals, and threshold levels are considered. Intermittency factor distribution, zone averages of velocity components, local convection velocity of the interface, point averages of shear stress in bulges, reconstructed flow fields, and the entrainment of ambient fluid are illustrated. Author (ESA)

N84-15451# Ecole Centrale de Lyon (France). Lab. de Mecanique des Fluides.
ASYMMETRIC TURBULENT FLOWS
R. Morel and G. Comte-Bellot *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 26 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Free and wall turbulent asymmetric flows generated as soon as unequal boundary conditions exist are described. Their main characteristic is the difference which occurs between the location at which the mean velocity (or mean temperature) reaches an extremum and the location at which the turbulent momentum (or heat flux) changes its sign. The subsequent counter-gradient transfer or energy reversal is discussed. Advanced closures which give acceptable results in most cases are introduced.
Author (ESA)

N84-15452# Ecole Centrale de Lyon (France).
THE CORE REGION OF CHANNEL FLOWS
G. Comte-Bellot *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 19 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Mutual eddy intrusion in the core of fully developed wall bounded flows for which turbulence generation occurs in two opposite directions of a section is discussed. Channel and pipe flows are analyzed. Experimental evidence suggests that rotation occurs in the core. Negative loops with a clear asymmetrical pattern appear. Space-time correlation data are consistent with forward rotational motion inside the bulges for either wall. Author (ESA)

N84-15453# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
EDDY DETECTION WITHIN TURBULENT SHEAR FLOWS
Ron F. Blackwelder *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 18 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Pattern recognition techniques for detecting coherent eddy structures in turbulent flows are described. Since the characteristic eddies of turbulent shear flows are often described by their spatial coherence, it is advantageous to record Eulerian data simultaneously at several locations in space. The spatial correlation, i.e., phase relation, is best observed in the direction of the mean shear. Training the feature selector and/or pattern detector to recognize bursts, sweeps, etc., and the selection of decision criteria for eddy presence are described. Author (ESA)

N84-15454# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
THE BURSTING PHENOMENON IN BOUNDED SHEAR FLOWS
Ron F. Blackwelder *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 12 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Streamwise counterrotating vortices; low speed streaks; inflectional velocity profiles; lift up of low speed streaks, oscillations, and violent mixing; and a sweep of higher speed fluid are discussed. The spanwise velocity component; flow visualization; and hot-wire flowmeter measurements are described. Shear layer instability and pressure distribution are summarized. Author (ESA)

N84-15455# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
LARGE SCALE MOTION IN TURBULENT BOUNDARY LAYERS
Ron F. Blackwelder *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 8 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Eddies in the outer flow field of turbulent boundary layers are described. The turbulent regions have a small velocity away from the wall, the nonturbulent zones move towards the wall. The wallward motion increases significantly deep in the valleys between the eddies, indicating that this region is important for mixing and entrainment. Zone averages of tangential Reynolds stress reveal that it occurs mostly near the backs of the eddies. Temperature tagging indicates that the backs consist of a shear layer which maintains its identity into the full turbulent region. Author (ESA)

N84-15456# Technische Univ., Berlin (West Germany).
SOME ASPECTS OF TWO-DIMENSIONAL COMPRESSIBLE TURBULENT BOUNDARY LAYERS
H. H. Fernholz *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 96 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Experimental data obtained in nominally two dimensional compressible turbulent boundary layers at supersonic speed are compared with concepts from low speed flows. The validity range of physical models of turbulent flows is considered. Dominating

flow parameters and turbulence field changes as compared with low speed flow are discussed. Interpretation of mean flow measurements for zero pressure gradient (adiabatic and isothermal wall); transition and low Reynolds number effects; wall roughness effects; and curvature and pressure gradient effects are treated. The law of the wall and the Crocco temperature velocity relationship are outlined. Interpretation of fluctuating flow measurements, including Reynolds stress effects, is treated. Author (ESA)

N84-15457# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
EFFECTS OF UNSTEADINESS ON TURBULENT BOUNDARY LAYERS
J. Cousteix and R. Houdeville *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 93 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Experimental analyses of oscillating turbulent flat plate boundary layers are discussed. Effects of adverse pressure gradient on oscillating turbulent boundary layers are described. Calculation of unsteady boundary layers is considered. It is shown that time mean flow is not affected by forced oscillation of the external flow. Average velocity profiles cannot be deduced from the time mean velocity profile by a quasisteady analysis, but can be represented by steady profiles. Unsteady effects are stronger with an adverse pressure gradient. Hysteresis in relationships between boundary layers characteristics was observed. Turbulence characteristics are modulated by the flow oscillation even at low frequency. At high frequency, turbulence characteristics are frozen in the outer region of the boundary layer. For low reduced frequencies integral methods give acceptable results. As the reduced frequency increases, use of a quasisteady skin friction law becomes wrong. Even at low reduced frequency, classic mixing length models give poor results (except for the time mean flow). Better results are obtained from transport equations models. Author (ESA)

N84-15458# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
THREE-DIMENSIONAL WAKE OF A SWEPT WING
J. Cousteix, G. Pailhas, and B. Aupoix *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 11 p refs Presented at 2nd Symp. on Numerical and Phys. Aspects of Aerodyn. Flows, Long Beach, Calif., 17-20 Jan. 1983 Previously announced in IAA as A84-10102 (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Mean velocity profiles and six components of the Reynolds stress tensor profiles were obtained by studying a three dimensional turbulent wake. Agreement between hot-wire techniques used to measure Reynolds stress is good, with a four wire probe being particularly promising. An integral technique for calculating wake development is presented. For solving the partial differential equations, a simple model in which the shear stress is assumed to be aligned with the y-derivative of mean velocity works well. Author (ESA)

N84-15459# Pennsylvania State Univ., University Park.
THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS
B. Lakshminarayana *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 68 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Analytical and numerical methods, and experimental data on three dimensional shear layers in external and internal flows are evaluated. Governing equations and turbulence closure models; velocity profile analysis; momentum integral technique; and finite difference techniques are discussed. Although existing techniques adequately predict mean velocities, and in many cases, skin friction coefficient, turbulence stress prediction requires more accurate turbulence models. Author (ESA)

N84-15460# Pennsylvania State Univ., University Park.
THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS IN TURBOMACHINES
B. Lakshminarayana *In* Von Karman Inst. for Fluid Dynamics Turbulent Shear Flows 1983 46 p refs (For primary document see N84-15448 06-34)
Avail: NTIS HC A23/MF A01

Turbulent shear layers in turbomachines are compared with turbulent boundary layers on airfoils. The effects of turbulent boundary layers on turbomachine performance (rotating blade, stator blade, end wall, annulus wall, rotating hub) are listed. Generalized equations; momentum integral techniques; velocity profile models; and skin friction stress calculation are summarized. Author (ESA)

N84-15461# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPUTATIONAL FLUID DYNAMICS, VOLUME 1
1983 293 p refs Proc. of Lecture Series, Rhode Saint Genese, Belgium, 7-11 Mar. 1983 2 Vol.
(VKI-LS-1983-04-Vol-1) Avail: NTIS HC A13/MF A01

Computational methods for ideal compressible flow; three dimensional mesh generation using transfinite interpolation; explicit multistage finite volume procedure to solve the Euler equations for transonic flow; vector coding the finite volume procedure for the Cyber 205; and higher order approximations in fluid mechanics (compact and Chebyshev pseudospectral methods) were discussed. For individual titles, see N84-15462 through N84-15466.

N84-15462*# Leiden Univ. Observatory (Netherlands).
COMPUTATIONAL METHODS FOR IDEAL COMPRESSIBLE FLOW
Bram vanLeer *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dyn., Vol. 1 1983 45 p refs (For primary document see N84-15461 06-34)
(Contract NAS1-15810)
Avail: NTIS HC A13/MF A01 CSCL 20D

Conservative dissipative difference schemes for computing one dimensional flow are introduced, and the recognition and representation of flow discontinuities are discussed. Multidimensional methods are outlined. Second order finite volume schemes are introduced. Conversion of difference schemes for a single linear convection equation into schemes for the hyperbolic system of the nonlinear conservation laws of ideal compressible flow is explained. Approximate Riemann solvers are presented. Monotone initial value interpolation; and limiters, switches, and artificial dissipation are considered. Author (ESA)

N84-15463# Aeronautical Research Inst. of Sweden, Bromma.
PRACTICAL THREE-DIMENSIONAL MESH GENERATION USING TRANSFINITE INTERPOLATION
Lars-Erik Eriksson *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dyn., Vol. 1 1983 53 p refs (For primary document see N84-15461 06-34)
Avail: NTIS HC A13/MF A01

A computational procedure for generating three dimensional nonorthogonal surface-fitted mesh systems is presented. The method is based on the concept of transfinite interpolation and uses normal derivatives of the mapping function at the boundaries to obtain the desired mesh control. The theory is presented together with 2D examples. The generation of 3D meshes of O-O type around wings and schematic wing-fuselage configurations is described and computed examples are shown. Author (ESA)

N84-15464# Aeronautical Research Inst. of Sweden, Bromma.
EXPLICIT MULTISTAGE FINITE VOLUME PROCEDURE TO SOLVE THE EULER EQUATIONS FOR TRANSONIC FLOW
Arthur Rizzi and Lars-Erik Eriksson *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dyn., Vol. 1 1983 33 p refs (For primary document see N84-15461 06-34)
Avail: NTIS HC A13/MF A01

A computational procedure for solving the Euler equations for transonic flow around aircraft upon an O-O mesh generated by transfinite interpolation is presented. An explicit time marching finite volume procedure solves the flow equations and features a nonreflecting far field boundary condition and an internal

mechanism for temporal damping together with a model for artificial viscosity. Convergence to a steady state is studied, and results computed on the CYBER 205 vector processor are presented. The Euler equation model is found to predict the existence of a tip vortex created by flow separating from the downstream region of the tip of the M6 wing where the radius of curvature approaches zero. Author (ESA)

N84-15465# Aeronautical Research Inst. of Sweden, Bromma.
VECTOR CODING THE FINITE VOLUME PROCEDURE FOR THE CYBER 205
Arthur Rizzi *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dyn., Vol. 1 1983 33 p refs (For primary document see N84-15461 06-34)
Avail: NTIS HC A13/MF A01

The architecture of supercomputers and fundamental principles of vector programming in FORTRAN are reviewed, and vector coding and execution of the finite volume procedure on the CYBER 205 are described. With the proper structure given to the data base each coordinate direction can be differenced throughout the entire grid in one vector operation. Boundary conditions must be interleaved, which inhibits the concurrency of the overall scheme. No data motion together with inner-loop vectorization is advocated. The computed example of transonic flow separating from the sharp leading edge of a delta wing demonstrates the performance of the procedure. Vectors over 20,000 elements long are obtained, and a rate of over 50 megaflops sustained over the entire computation indicates the high degree of vectorization achieved. Author (ESA)

N84-15466# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
HIGHER ORDER APPROXIMATIONS IN FLUID MECHANISMS: COMPACT TO SPECTRAL
Richard S. Hirsh *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dyn., Vol. 1 1983 119 p refs (For primary document see N84-15461 06-34)
Avail: NTIS HC A13/MF A01

Higher order methods for solving the Navier-Stokes equations are introduced. Compact methods, Hermitian methods (collocation and difference), Mehrstellen methods, Pade methods and splines are reviewed. Pseudospectral Chebyshev methods are presented. The Chebyshev grid, which clusters interpolation points near the boundaries of a domain, is almost a natural coordinate transformation in the high gradient region, and may allow higher Reynolds numbers to be computed for the same number of modes as finite difference methods. However, there is an upper limit to the Reynolds number which can be reliably calculated for each grid, so coordinate transformations have to be resorted to. Author (ESA)

N84-15467# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPUTATIONAL FLUID DYNAMICS, VOLUME 2
1983 361 p refs Proc. of Lecture Series, Rhode-Saint-Genese, Belgium, 7-11 Mar. 1983 2 Vol.
(VKI-LS-1983-04-Vol-2) Avail: NTIS HC A16/MF A01

Least squares and domain decomposition methods for numerical solution of nonlinear problems in fluid dynamics; numerical computation of transonic flow governed by the full potential equation; computation of turbulent gas-particle suspension flows in channels; and the accuracy of the finite difference computations of recirculating free convective flows were discussed. For individual titles, see N84-15468 through N84-15471.

N84-15468# Paris VI Univ. (France).
LEAST SQUARES AND DOMAIN DECOMPOSITION METHODS APPLIED TO THE NUMERICAL SOLUTION OF NONLINEAR PROBLEMS IN FLUID DYNAMICS
R. Glowinsky and J. Periaux (Avions Marcel Dassault, St. Cloud, France) *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dyn., Vol. 2 1983 137 p refs (For primary document see N84-15467 06-34)
(Contracts DRET-82/043; DRET-80/493)
Avail: NTIS HC A16/MF A01

Finite element approximations to handle complicated geometries; nonlinear least squares formulations; conjugate gradient methods with scaling to solve the least squares problems; and subdomain decomposition to reduce the solution of very large problems to the solution of problems of the same type but on smaller domains using vector processors are discussed. Coupling of nonlinear least squares methods with arc length continuation is considered. The full potential equation for compressible inviscid transonic flows and the Navier-Stokes for incompressible viscous flows are solved via finite element approximations. Domain decomposition methods implementation on a computer system with parallel processing possibilities is outlined. Numerical experiments results are presented. Author (ESA)

N84-15469*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL COMPUTATION OF TRANSONIC FLOW GOVERNED BY THE FULL-POTENTIAL EQUATION
Terry L. Holst *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dyn., Vol. 2 1983 110 p refs (For primary document see N84-15467 06-34)
Avail: NTIS HC A16/MF A01

Basic concepts associated with the numerical solution of elliptic partial differential equations are introduced, and procedures used to solve the full potential equation for transonic flow fields are discussed. Governing equations, classical relaxation schemes and concepts regarding transonic, full potential equation algorithms are covered. The equation transformation and grid generation procedures; full potential spatial differencing schemes; full potential iteration schemes, emphasizing convergence acceleration; and three dimensional applications are presented. Author (ESA)

N84-15470# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPUTATION OF TURBULENT GAS-PARTICLE SUSPENSION FLOWS IN CHANNELS
L. Lourenco and J. A. Essers *In its* Computational Fluid Dyn., Vol. 1 1983 54 p refs (For primary document see N84-15467 06-34)
Avail: NTIS HC A16/MF A01

The mathematical model for gas-solid suspensions in turbulent motion, derived from a combination of continuum theory and the Boltzmann statistical method, is applied to the study of a steady, two dimensional motion in a horizontal duct. The numerical methods allowing the solution of the coupled Boltzmann equation and the Navier-Stokes equations are presented. Finite differencing is used and an implicit scheme is employed. The equations are discretized in the conservation form and the coupled gas and particles equations are solved simultaneously in an interactive manner. The gas equations are solved in a scheme where the pressure gradient is found using a method avoiding iterations. The equation for the particle distribution function is solved using an approximate factored scheme. Author (ESA)

N84-15471# Liege Univ. (Belgium).
THE ACCURACY OF THE FINITE DIFFERENCE COMPUTATIONS OF RECIRCULATING FREE CONVECTIVE FLOWS
Jean J. Portier *In* Von Karman Inst. for Fluid Dynamics Computational Fluid Dyn., Vol. 2 1983 57 p refs (For primary document see N84-15467 06-34)
Avail: NTIS HC A16/MF A01

The determination of natural flow and heat transfer in a square, two dimensional cavity, whose vertical boundaries are held at different but constant temperatures and whose horizontal walls are perfectly insulated, was used to assess numerical solutions of nonlinear elliptic differential equations. With a resonable grid density, the reduction of the diverging effects ascribed to standard finite difference solution procedures requires the means of their quantitative assessment. This can be achieved using the false transient method, whose convergence behavior makes it one of

the most efficient algorithms to obtain solutions of the coupled system of elliptic equations. Author (ESA)

N84-15472# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AEROTHERMODYNAMICS OF LOW PRESSURE STEAM TURBINES AND CONDENSERS, VOLUME 1
1983 328 p refs Proc. of Lecture Series, Rhode-Saint-Genese, Belgium, 16-20 May 1983 2 Vol.
(VKI-LS-1983-06-Vol-1) Avail: NTIS HC A15/MF A01

The design of low pressure steam turbines; turbine aerodynamic design using through flow theory (meridional through flow calculation); aerodynamics and steam wetness fraction of a multistage turbine; measurements in steam turbines; applications of through flow theory; trends in steam turbine design, testing and manufacturing; a method of calculating fully three dimensional inviscid flow through any type of turbomachine blade row; research on the aerodynamics of axial flow turbines; and three dimensional flow calculations on a hypothetical steam turbine last stage were discussed. For individual titles, see N84-15473 through N84-15481.

N84-15473# Brown, Boverie und Cie, A.G. Baden (Switzerland).
THE DESIGN OF MODERN LOW PRESSURE (LP) STEAM TURBINES **c37**
A. Roeder *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 47 p (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

Economic factors involved in designing low pressure steam turbines are discussed. The structural design of a 3600 rpm 1300 MW turbine, and 1800 rpm 900 to 1300 MW turbine is summarized. Bearings and supports, and condenser arrangement are described. Cold end optimization, and inlet pressure for fossil fired and nuclear power plants are treated. Inlet casings, rotor and blading, and low pressure outlet are covered. Author (ESA)

N84-15474# Genoa Univ. (Italy).
TURBINE AERODYNAMIC DESIGN USING THROUGH-FLOW THEORY. MERIDIONAL THROUGH-FLOW CALCULATION **c37**
M. Troilo *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 44 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

The streamline curvature method (SCM) for calculating through flow in axial flow steam turbines is introduced. It consists of a row of one-dimensional calculations, along meridional streamlines, coupled by a radial equilibrium equation (REE). Along the meridional streamlines the energy law in the usual enthalpy formulation is used, together with kinematic relationships to switch from the absolute to the relative flow and vice-versa, and geometric relationships between flow angles and velocity components. The radial distribution of quantities is calculated by integration of REE, that may assume different forms. There are two main iteration levels: mass flow and streamline. Loss and flow angle calculation, and wetness effects are described. Application to a last stage design is summarized. Author (ESA)

N84-15475# Ansaldo S.p.A., Genoa (Italy). Power Generation Div.
AERODYNAMICS AND STEAM WETNESS FRACTION OF A MULTISTAGE TURBINE. COMPARISON OF PREDICTION WITH EXPERIMENTAL DATA **c37**
A. Accornero and L. Maretto *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 26 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

Tests were carried out on a 320 MW low pressure steam turbine cylinder at several loads and condenser pressure levels. Aerodynamic and optical probes were used for traversing inside the turbine to investigate interstage flow field, and to evaluate steam wetness fraction. Contemporary cycle measurements allowed for a continuous power plant monitoring and checking of turbine stability. Test results were compared with theoretical predictions obtained by a through flow calculation program, particulary for condensation shock effects on the flow through the last stage. Differences between theory and experiment are attributed to machine aging and the circumferential nonuniformity of the flow, particulary important at the exhaust of the turbine, which are not taken into account by the calculation program.
Author (ESA)

N84-15476# Central Electricity Research Labs., Leatherhead (England).
MEASUREMENTS IN STEAM TURBINES **c37**
M. J. Moore *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers 1983 39 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

Research and development in instrumentation for low pressure turbine performance measurement, particularly the determination of steam wetness fraction by an optical method based on measuring the transmittance of the steam suspension are reviewed. Determination of end point enthalpy, aerodynamic measurements, and the momentum method of determining stage efficiency are discussed. It is concluded that overall efficiency can be obtained by optical probe, but the momentum method more accurately reflects the radial distribution of losses. Author (ESA)

N84-15477# Westinghouse Electric Corp., Philadelphia, Pa.
APPLICATIONS OF THROUGH-FLOW THEORY
David H. Evans *In* Von Karman Inst. of Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 40 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

The streamline curvature and matrix through flow solution techniques for meridional flow field problems are reviewed. A design method, based on the matrix through flow method is outlined, and verification of the method with a retrofit of a large low pressure fossil fuel steam turbine is summarized. An analysis flow field equation for a turbine of known geometry is presented. Uses of blade loss data in turbine design are discussed.
Author (ESA)

N84-15478# Westinghouse Electric Corp., Philadelphia, Pa.
TRENDS IN STEAM TURBINE DESIGN, TESTING AND MANUFACTURING **c37**
David H. Evans *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 41 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

The economic and technological benefits of improving the design of steam turbine generators already installed are described. Laboratory test facilities for verification of mechanical and thermal performance of turbines and components are presented. Low pressure nuclear turbine designs which exploit matrix through flow theory and stall flutter analysis are introduced. Trends in plant design and manufacturing are traced. Author (ESA)

N84-15479# Cambridge Univ. (England).
A METHOD OF CALCULATING FULLY THREE DIMENSIONAL INVISCID FLOW THROUGH ANY TYPE OF TURBOMACHINE BLADE ROW **c37**
J. D. Denton *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 40 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

A suite of computer programs to calculate the fully 3D inviscid flow through any type of turbomachine blade row was developed. The method is based on a pseudo time dependent solution of the Euler equations with convergence accelerated by a multigrid approach. It is shock capturing and has no Mach number limitations. The basic version of the program can cope with any type of single blade row, compressor or turbine with axial, mixed,

or radial flow. Special versions of the code were developed for blade rows with part-pitch or part-span splitter blades and also for two blade rows in relative rotation, i.e., a complete stage. Viscous effects may be approximated by a transpiration type of boundary layer displacement model. Author (ESA)

N84-15480# Cambridge Univ. (England).
A REVIEW OF CURRENT RESEARCH ACTIVITY ON THE AERODYNAMICS OF AXIAL FLOW TURBINES c37
J. D. Denton *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 31 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

Design philosophy of axial flow turbines, flow and performance prediction methods, blade section design, secondary loss reduction, and last stage aerodynamics are reviewed, especially for large steam turbines. For most machines improvements are still possible through the use of smooth hub and casing shapes, twisted blades and reduced tip clearances. More general improvements are likely to come from methods of reducing loss in low aspect ratio blading. Last stage performance should benefit from better flow calculation methods and from the realization of the dangers of using too low a hub:tip ratio. Author (ESA)

N84-15481# Cambridge Univ. (England).
THREE-DIMENSIONAL FLOW CALCULATIONS ON A HYPOTHETICAL STEAM TURBINE LAST STAGE
J. D. Denton *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 13 p (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

Fully three dimensional flow calculations were used to investigate the effects of geometry on the flow through a steam turbine last stage. The human effort involved is much less than when using iterative through flow blade to blade methods. Each of the solutions requires 1 hr human time and 4 hr computer time to prepare, plot and run the data. The results indicate that effects of nozzle lean are greater than those of any other modification. By use of lean, possibly in combination with twisted nozzle blades, large increases in rotor root reaction can be obtained.
Author (ESA)

N84-15482# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AEROTHERMODYNAMICS OF LOW PRESSURE STEAM TURBINES AND CONDENSERS, VOLUME 2
1983 285 p refs Proc. of Lecture Series, Rhode-Saint-Genese, Belgium, 16-20 May 1983 2 Vol.
(VKI-LS-1983-06-Vol-2) Avail: NTIS HC A13/MF A01

Wet steam flow in low pressure turbines; two dimensional condensing flow in transonic turbine cascades; steam condenser thermal design theories; and developments in steam condenser size and tubing were discussed. For individual titles, see N84-15483 through N84-15486.

N84-15483# Cambridge Univ. (England). Whittle Lab.
WET STEAM FLOW IN L. P. TURBINES
J. B. Young *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and condensers, Vol. 2 1983 70 p refs (For primary document see N84-15482 06-34)
Avail: NTIS HC A13/MF A01

The fluid mechanics of wet steam flows, choking in nonequilibrium flows, and through flow calculations in low pressure turbines are reviewed. Gas dynamic equations; steam properties; nucleation; droplet growth; calculation of the wetness fraction; the supercooling equation; and thermodynamic wetness loss are discussed. Mass flowrate in unchoked flows; critical conditions in choked flows; choking in converging nozzles; and choking in converging-diverging nozzles are treated. The primary nucleating stage; the effect of droplet size on last stage performance; and application of a streamline curvature technique to the Ansaldo test cases are described. Author (ESA)

N84-15484# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TWO DIMENSIONAL CONDENSING FLOW IN TRANSONIC TURBINE CASCADES
J. Snoeck *In its* Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 2 1983 40 p refs (For primary document see N84-15482 06-34)
Avail: NTIS HC A13/MF A01

A method for predicting spontaneous condensation in nozzles is presented. The conservation laws are formulated separately for each phase, and the vapor phase equations are integrated with a time marching scheme. An analytical solution of the liquid phase equations provides the droplet growth model. Calculations suggest that the two dimensional character of the flow plays a decisive role in the appearance of the liquid phase. The first droplets appear along the suction side where reversion to thermodynamic equilibrium can take place before the flow reaches the trailing edge. This is not so along the pressure side, where the steam remains subcooled because of the lower expansion rate. The heat released by the droplets affects the blade pressure distribution. When an aerodynamic shock impinges on the suction side in dry conditions, its strength can be substantially reduced by condensation. The outlet flow angle variation can reach several degrees with respect to the value computed for the same pressure ratio and superheated steam. Author (ESA)

N84-15485# Central Electricity Research Labs., Leatherhead (England).
STEAM CONDENSER THERMAL DESIGN THEORIES
B. J. Davidson *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 2 1983 122 p refs (For primary document see N84-15482 06-34)
Avail: NTIS HC A13/MF A01

Test data and prediction methods for condensation in steam condenser tube banks are reviewed. Standards for thermal rating; effect of vapor velocity; vapor shear and inundation in tube banks; correction factors to the Nusselt equation; and equations for the combined effect of vapor shear and inundation are discussed. Effects of noncondensible gases; tube side heat transfer; and expressions for combined tube side and shell side heat transfer are considered. Frictional, gravitational, momentum, and pressure drop trends; and the role of access lanes to reduce pressure drop are outlined. Computer models of condensers, including algebraic representations of the field equations, are summarized. Author (ESA)

N84-15486# Brown, Boverie und Cie, A.G. Baden (Switzerland).
STEAM CONDENSER DEVELOPMENTS
H. V. Lang *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 2 1983 51p refs (For primary document see N84-15482 06-34)
Avail: NTIS HC A13/MF A01

Factors determining condenser size and tube arrangement are reviewed, including steam side pressure drop; incondensible blanketing; effect of incondensibles on heat transfer; vent requirements; deaeration; condensate depression; cooling water velocity; tube material and diameter selection; fouling; and enhanced heat transfer tubes. Tube nest shapes and condenser concepts are described. Thermal design, and condenser acceptance testing are treated; field test results on 'Church Window" condensers are reported. Author (ESA)

N84-15487# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THERMOHYDRAULICS OF LIQUID METALS, VOLUME 1
1983 311 p refs Proc. of Lecture Series, Rhode Saint Genese, Belgium 30 May-3 Jun. 1983 2 Vol.
(VKI-LS-1983-07-Vol-1) Avail: NTIS HC A14/MF A01

Mixed convection and stratification phenomena in liquid metals; single-phase sodium flow in complex and deformed geometries; turbulence modeling in liquid metal free convection; liquid metal experimental falicities; and sodium boiling phenomena in out of pile rod bundles for accident situations in liquid metal

fast breeder reactors were discussed. For individual titles, see N84-15488 through N84-15493.

N84-15488# Centre National de la Recherche Scientifique, Grenoble (France). Centre d'Etudes Nucleaires.
MIXED CONVECTION AND STRATIFICATION PHENOMENA IN LIQUID METALS
D. Grand *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 1 1983 52 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

Combined, forced and natural convection in liquid metals are reviewed, particularly in liquid metal fast breeder reactors for low flow rates and reduced power. Combined convection in vertical channels; and thermal stratification are considered. Liquid metals have very small values of the Prandtl number. Heat transfer in these fluids is characterized by the importance of molecular conduction, and the small influence of viscosity. This is shown in two simple cases of boundary layers flows. It should be taken into account in the choice of dimensionless governing parameters used for the presentation of heat transfer results. For combined convection on a vertical channel with a simple cross section (rectangular or circular), many results are available, but the data on the phenomenon in generalized geometries (core, rod bundles, subchannels) are lacking. Author (ESA)

N84-15489# Societe Belge pour l'Industrie Nucleaire, Brussels (Belgium).
SINGLE PHASE SODIUM FLOW IN COMPLEX AND DEFORMED GENERATORS c73
P. Kunsch *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 1 1983 42 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

The thermohydraulic design of fast reactor fuel assemblies cooled by liquid sodium is discussed. Analysis methods; subassemblies with wire or grid spacers; deformed bundles and contact geometries in normal operation and following accidents are discussed. Mass flow distribution and temperature distribution in the cooling system are described, along with computer models and calculation methods. Author (ESA)

N84-15490# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENCE MODELING IN LIQUID METAL FREE CONVECTION
C. Benocci *In its* Thermohydraulics of Liquid Metals. Vol. 1 1983 67 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

Natural convection within an enclosed cavity filled by liquid sodium is reviewed and the transition to turbulence is investigated with a numerical model, to study heat removal in a reactor core where the forced circulation of the coolant fails. For side heated square cavities turbulence onset is detected at Grashof number (Gr) = 10 million, of the same order as the ones found for fluids having higher Prandtl numbers. However, due to the extremely high value of the turbulent Prandtl number heat transfer remains unaffected by the turbulence, until Gr becomes at least one order of magnitude higher. A laminar prediction model can be applied up to Gr = 100 million. For bottom heated square cavities transition to turbulence begins at relatively low values of Gr and high levels of turbulence are reached quite soon. Unsteady flow patterns develop and laminar solutions tend quickly to instability.
Author (ESA)

N84-15491# Joint Research Centre of the European Communities, Ispra (Italy).
THERMOHYDRAULICS IN LIQUID METALS
H. M. Kottowski *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics in Liquid Metals, Vol. 1 1983 56 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

Heat transfer problems in single-phase and two-phase liquid metal forced convection flow are reviewed. Liquid metal boiling heat transfer in pool flow; and dry out heat fluxes are considered. It is shown that in technological plants working with liquid metals, superheating up to 150 C occurs, and can lead to nonstationary hydraulic transition between the single-phase and established two-phase flows. Boiling phases relative to subcooled boiling and bubble boiling have no importance for technological processes. Piston, slug and annular flow patterns dominate. On the basis of the flow patterns observed during boiling, the separate flow model principle is the only one suitable for calculating the two-phase flow pressure drop. Using this model and total pressure drop measurements, a relationship for the two-phase frictional pressure characteristic, valid for tubular and annular geometry, can be determined. Author (ESA)

N84-15492# Joint Research Centre of the European Communities, Ispra (Italy).
LIQUID METAL EXPERIMENTAL FACILITIES c73
H. M. Kottowski *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics in Liquid Metals, Vol. 1 1983 49 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

Design features and mode of operation of components required to operate forced convection heat transport loops in laboratory and commercial application are reviewed. Loop specific components, instrumentation methods and sensors for measuring the fluid characteristic parameters for flow control are described. Safety and reliability rules are discussed. Author (ESA)

N84-15493# Centre National de la Recherche Scientifique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDIES ON SODIUM BOILING PHENOMENA IN OUT OF PILE ROD BUNDLES FOR VARIOUS ACCIDENTAL SITUATIONS IN LIQUID METAL FAST BREEDER REACTORS (LMFBR) EXPERIMENTS AND INTERPRETATIONS c73
J. M. Seiler and B. Rameau *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 1 1983 38 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

Bundle sodium boiling in nominal geometry for different accident conditions is reviewed. Voiding of a subassembly is controlled by not only hydrodynamic effects but mainly by thermal effects. There is a strong influence of the thermal inertia of the bundle material compared to the sodium thermal inertia. Flow instability, during a slow transient, can be analyzed with numerical tools and estimated using simplified approximations. Stable boiling operational conditions under bundle mixed convection (natural convection in the reactor) can be predicted. Voiding during a fast transient can be approximated from single channel calculations. The phenomenology of boiling behavior for a subassembly with inlet completely blocked, submitted to decay heat and lateral cooling; two-phase sodium flow pressure drop in a tube of large hydraulic diameter under adiabatic conditions; critical flow phenomena and voiding rate under high power, slow transient conditions; and onset of dry out under local boiling remains problematical. Author (ESA)

N84-15494# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THERMOHYDRAULICS OF LIQUID METALS, VOLUME 2
1983 348 p refs Proc. of Lecture Series, Rhode-Saint-Genese, Belgium, 30 May-3 Jun 1983 2 Vol.
(VKI-LS-1983-07-Vol-2) Avail: NTIS HC A15/MF A01

Temperature distributions, boiling and dry out behind local blockages in liquid metal fast breeder reactors (LMFBR); sodium boiling experiments in bundle geometries under fast transient and steady state conditions; BLOW 3A, a theoretical model to describe transient two phase flow conditions in LMFBR coolant channels; theoretical simulation of thermohydraulic behavior of sodium cooled subassemblies in steady state and transient conditions; computation of the thermohydraulics in subassemblies for accident situations; thermohydraulics of LMFBR core catchers; and non-nuclear thermohydraulic applications of liquid metals were

discussed. For individual titles, see N84-15495 through N84-15501.

N84-15495# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwichlung.
TEMPERATURE DISTRIBUTIONS, BOILING AND DRY-OUT BEHIND LOCAL BLOCKAGES
F. Huber and W. Peppler *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 56 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

The temperature distribution in the region of impaired cooling of an LMFBR with local blocking in a fuel subassembly was studied in water and sodium experiments in pin bundles of various sizes. Fuel elements with a 49% central and a 21% corner blockage were simulated. Pin cooling in the wake of the blockage was investigated in single-phase conditions, in boiling conditions up to dryout and in conditions simulating gas release from failed pins. The studies demonstrate that the consequences of a local blockage do not lead to rapid propagation of damage within a pin bundle, and provide data for validation of theoretical models. Author (ESA)

N84-15496# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
SODIUM BOILING EXPERIMENTS IN BUNDLE GEOMETRIES UNDER FAST TRANSIENT AND STEADY STATE CONDITIONS c73
F. W. Peppler *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 45 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

Flow loss experiments were carried out in tubular and 7 pin test-sections and in a sodium cooled 37 pin bundle with sinusoidal axial heat flux profile. Thermohydraulic behavior under fast loss of flow conditions, particularly three-dimensional phenomena such as the development of the temperature distribution, the boiling region, the onset and extension of dryout, and the flow regimes related to different boiling periods were studied. The experimental results provide data for the validation of three-dimensional two-phase hydrodynamic codes. Stationary boiling tests provide information on two-phase pressure drop in bundles, the flow regimes and the conditions prevailing during the approach to critical heat flux conditions. Author (ESA)

N84-15497# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
THE BLOW-3A: A THEORETICAL MODEL TO DESCRIBE TRANSIENT TWO PHASE FLOW CONDITIONS IN LIQUID METAL FAST BREEDER REACTOR (LMFBR) COOLANT CHANNELS c73
M. Bottoni and D. Struwe *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 61 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

The theoretical background of the BLOW-3A program is reported, including the basic equations used to determine temperature fields in the fuel, clad, coolant and structure material as well as the coolant dynamics in single and two-phase flow conditions. The two-phase flow model assumes an annular flow regime. Special aspects to calculate two-phase pressure drops for these conditions are discussed. Examples of the experimental validation of the program are given. Author (ESA)

N84-15498# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
THEORETICAL SIMULATION OF THERMOHYDRAULIC BEHAVIOR OF SODIUM COOLED SUBASSEMBLIES IN STEADY STATE AND TRANSIENT CONDITIONS c73
M. Bottoni and D. Struwe *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 74 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

Computer programs for the analysis of the thermohydraulic behavior of the coolant in LMFBR subassemblies are reviewed. Modeling approach and computational techniques employed for the numerical solution of the governing equations are discussed. The main characteristics of the three-dimensional single-phase flow version of the BACCHUS code are explained. Its validation against experimental data and the basis for the development of a two-phase flow version are outlined. Author (ESA)

N84-15499# Centre National de la Recherche Scientifique, Grenoble (France). Centre d'Etudes Nucleaires.
COMPUTATION OF THE THERMOHYDRAULICS IN SUBASSEMBLIES FOR ACCIDENT SITUATIONS c73
G. Basque *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 34 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

Single-phase and two phase flow models of sodium boiling in an LMFBR are described. Results for single-phase calculations with mixed and natural convection, and for voiding of a subassembly are presented. A 2-D two-phase version of the computer code BACCHUS based on a homogeneous flow model with disequilibrium was tested. It yields results which are computationally stable and physically consistent. The validity of the porous body model for liquid flow is established by calculating representative single flows. Author (ESA)

N84-15500# United Kingdom Atomic Energy Authority, Culham (England).
THERMOHYDRAULICS OF LMFBR CORE CATCHERS c73
B. D. Turland *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 43 p refs (For primary document see N84-15494 06-34)
(Contract C93/293)
Avail: NTIS HC A15/MF A01

Characterization of the likely form of fuel debris after an accident, following interaction with sodium in the primary vessel and mechanisms controlling the location of the debris in the primary system is discussed. Heat transfer from particulate to liquid sodium and the development of models predicting the amount of debris that may be retained in a coolable form on a structure are considered. The evaluation of the coolability of the structure itself in post accident conditions, particularly the cooling provided by natural convection alone is treated. The response of structures at elevated temperatures and under high thermal loads is considered. The potential for vessel failure if significant quantities of debris accumulate at the bottom of the vessel is shown. The performance of a flat plate core catcher, or similar structure with good cooling from underneath is evaluated. Author (ESA)

N84-15501# Societe Belge pour l'Industrie Nucleaire, Brussels (Belgium).
THERMOHYDRAULIC APPLICATIONS OF LIQUID METALS IN THE NON-NUCLEAR FIELD
A. Michel *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 42 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

Liquid metal applications in power generation (solar and conventional), magnetohydrodynamics, heat pipes, metallurgy, nuclear fusion, and heat storage are summarized. Liquid metal properties are outlined, and the metals are compared with competing fluids. Author (ESA)

N84-15502# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE EFFECTS OF ACOUSTIC EXCITATION ON THE MIXING OF TWO PARALLEL LAMINAR STREAMS OF FLUID Final Scientific Report, 15 May 1982 - 14 Feb. 1983
Ernie Lewis Jun. 1982 43 p refs
(Grant AF-AFOSR-0203-82; AF Proj. 3201)
(AD-A126788; EOARD-TR-83-6) Avail: NTIS HC A03/MF A01 CSCL 20/4

The effects of acoustic excitation on the mixing of two parallel

streams were examined. It is found that acoustic excitation may have a large effect on enhancing the mixing of two parallel streams. The process of the excitation is outlined. E.A.K.

N84-15503# National Aeronautical Establishment, Ottawa (Ontario).
UNSTEADY PRESSURE AND FORCE MEASUREMENTS ASSOCIATED WITH TRANSONIC BUFFETING OF A TWO-DIMENSIONAL SUPERCRITICAL AIRFOIL
B. H. K. Lee and L. H. Ohman Jun. 1983 89 p
(AD-A133139; NAE-AN-14; NRC-22448) Avail: NTIS HC A05/MF A01 CSCL 20/4

Buffet characteristics of the BGK No. 1 shockless airfoil have been investigated. Fluctuating pressure measurements along the airfoil chord and unsteady force balance data have been obtained in various regions inside the buffet regime close to the onset boundary curve. The Mach number range where buffet intensity reaches high values is determined from balance measurements. The rms values of the fluctuating pressure show generally monotonic increase downstream of the shock to the trailing-edge in this speed range. Statistical data from pressure and normal force measurements have been processed and the appearance of distinct frequency peaks in the power spectral density curves has been detected. GRA

N84-15504# ARO, Inc., Arnold Air Force Station, Tenn.
THREE-DIMENSIONAL, TIME-DEPENDENT, COMPRESSIBLE, TURBULENT, INTEGRAL BOUNDARY-LAYER EQUATIONS IN GENERAL CURVILINEAR COORDINATES AND THEIR NUMERICAL SOLUTION Final Report, Aug. 1982 - Aug. 1983
Timothy Wade Swafford AEDC Sep. 1983 136 p Prepared in cooperation with Sverdrup Technology, Inc., Arnold AFS, TN
(AD-A133289; AEDC-TR-83-37) Avail: NTIS HC A07/MF A01 CSCL 20/4

A method is presented for computing three-dimensional, time-dependent, compressible, turbulent boundary layers in nonorthogonal curvilinear coordinates. An integral method is employed in the interest of computational speed and because the three-dimensional method is an extension of an existing two-dimensional method. After presenting a detailed derivation of the integral form of the boundary-layer equations, the necessary auxiliary relations are given along with the relationships between integral lengths expressed in streamline and nonorthogonal coordinates. A time dependent approach is used to account for time accuracy (if desired) and to provide a method that is compatible with the surface grid used by an inviscid solver for use in viscous-inviscid interaction calculations. The equations are solved using a Runge-Kutta scheme with local time stepping to accelerate convergence. Stability and convergence of the numerical scheme are examined for various space differences compared with measurements and with computations of previous investigators. GRA

N84-15505# Naval Research Lab., Washington, D. C.
THE RELATION BETWEEN POWER AND ENERGY IN THE SHOCK INITIATION OF DETONATIONS. 1: BASIC THEORETICAL CONSIDERATIONS AND THE EFFECTS OF GEOMETRY
K. Kailasanath and E. S. Oran 15 Sep. 1983 46 p
(AD-A133468; NRL-MR-5179) Avail: NTIS HC A03/MF A01 CSCL 20/4

Recent studies on the direct initiation of gaseous detonations have shown that initiation depends not only on the energy deposited but also on the rate at which it is deposited, namely the power. In this paper, we have used a theoretical model to determine the relation between the power and the energy required for the initiation of planar, cylindrical and spherical detonations in a detonable gas mixture. The results from the model show that the qualitative differences in the power-energy relations obtained from two different experimental arrangements are due to differences in the geometry. We also show that the minimum power requirement corresponds to a shock of the minimum. Mach number only in the case of planar detonations. Finally, the effect on the power-energy relation of the ratio of specific heats and the experimental uncertainties in the determination of the induction times have been studied for an acetylene-oxygen-nitrogen mixture. Author (GRA)

N84-15506# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
CAVITATION INCEPTION OBSERVATIONS ON AXISYMMETRIC HEADFORMS WITH TURBULENCE STIMULATORS Final Report
Thomas T. Huang, Garnell S. Belt, and Nancy C. Groves Sep. 1983 52 p
(SR0230101)
(AD-A133517; DTNSRDC-83/071) Avail: NTIS HC A04/MF A01 CSCL 20/4

Cavitation inception observations were made in the DTNSRDC 36-inch water tunnel on three axisymmetric headforms with and without various turbulence stimulators installed. Direct measurements of transition, made on two of the headforms with and without distributed surface roughness, were found to correlate reasonably well with the computed spatial amplification factors, e to the Nth power with $7 < \text{or} = N < \text{or} = 10$. The computed e to the Nth power factors were then used to estimate transition at other test conditions (without direct transition measurements). The predicted transition locations on all three smooth headforms occur at position considerably aft of the minimum pressure locations. The three smooth headforms have different types of incipient cavitation--small band, transient spot, traveling bubble, and attached spot. The measured cavitation inception numbers for those cases are all significantly smaller than the computed negative values of the minimum pressure coefficient, -C sub pmin. The predicted transition locations on the three headforms with densely- and loosely-packed 60 micron distributed roughness occur a considerable distance upstream of the minimum pressure locations. Therefore, the flows over all three headforms with distributed roughness are turbulent at the C sub pmin locations for the Reynolds numbers tested. Under this condition, the measured cavitation inception numbers are found to approximate well the values of -C sub pmin. The incipient cavitation is in the form of attached small bubble lines evenly distributed around the minimum pressure locations. Author (GRA)

N84-15507# McElroy (Ralph) Co., Austin, Tex.
PROCESS FOR ISOTOPE SEPARATION
Frances Marcel emile Biezel Nov. 1983 30 p Transl. into ENGLISH of French Patent no. 74-21387 (30 Jun. 1974)
(DE84-001983; UCRL-Trans-11923) Avail: NTIS HC A03/MF A01

The present invention concerns a process for isotope separation applicable to a very large number of isotopes under economic conditions. There are numerous processes for isotope separation, but they are costly essentially for the following reasons. The differences in physical properties used are generally very limited and only permit the application of poorly selective processes that require numerous recyclings, this being the case for gaseous diffusion, for example, or the use of costly and delicate apparatuses with mediocre energy efficiency, this being the case of electromagnetic separation, for example. DOE

N84-15508# Argonne National Lab., Ill. Components Technology Div.
FULLY COUPLED CALCULATION OF FLUID FLOWS WITH LIMITED USE OF COMPUTER STORAGE
S. P. Vanka Oct. 1983 30 p refs
(Contract W-31-109-eng-38)
(DE84-002218; ANL-83-87) Avail: NTIS HC A03/MF A01

The performance of a modification to an earlier solution algorithm for the calculation of multidimensional fluid flow, heat transfer, and combustion processes is described and demonstrated. The modification significantly reduces the computer storage required by the earlier algorithm without degrading the rate of convergence. The modification called telescoping subdomain analysis (TSDA), splits the flow domain into overlapping subregions and solves them in a sequence, with known conditions on the boundaries of the subregions. The procedure was tested in four

different two dimensional recirculating flows and the convergence rates are equivalent to the rates with full domain analysis. The modification offers significant savings of computer storage and cost and permits calculations with larger finite difference grids.
DOE

N84-15509# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL SOLUTION TO THE STEADY STATE EQUATION OF TRANSFER IN AZIMUTHALLY SYMMETRIC GEOMETRIES
E. Garelis, T. E. Rudy, and R. B. Hickman 1983 41 p refs Presented at the 2nd Intern. Conf. on Radiative Properties of Hot Dense Matter, Sarasota, Fla., 31 Oct. - 4 Nov. 1983 Submitted for publication
(Contract W-7405-eng-48)
(DE84-001781; UCRL-89923; CONF-8310178-2) Avail: NTIS HC A03/MF A01

The GLAM code can be used to calculate the various moments for the time independent equation of transfer for azimuthally symmetric problems. In particular, due to its unique method of calculating the cut-off angles, GLAM provides accurate view factors that can be used in conjunction with heat transfer calculations. In addition, since GLAM uses an integral approach, accurate answers can be obtained for specialized problems. DOE

N84-15510# Los Alamos Scientific Lab., N. Mex.
OPTICAL DIAGNOSTICS FOR CONDENSED-PHASE SHOCK-COMPRESSED MOLECULAR SYSTEMS
S. C. Schmidt, D. S. Moore, and J. W. Shaner 1983 69 p refs Presented at Los Alamos/CEA High Explosives and Detonation Phys. Conf., Paris, 3 Oct. 1983 Submitted for publication
(Contract W-7405-eng-36)
(DE84-001172; LA-UR-83-2847; CONF-8310148-11) Avail: NTIS HC A04/MF A01

Experimental techniques capable of obtaining information about the molecular phenomenology in the region through and immediately behind the shockfront during the shock-compression of condensed-phase molecular systems are discussed and compared. Difficulties associated with performing measurements in this region are reviewed. Some concomitant static experiments that can be used to complement the dynamic measurements, are suggested. Developments and advances expected in diagnostic techniques during the next few years are summarized. DOE

N84-15511# Los Alamos Scientific Lab., N. Mex.
TWO-PHASE FLOW STUDIES
R. J. Hanold 1983 18 p refs Presented at 2nd Ann. DOE Geothermal Progr. Rev. Meeting, Washington, D.C., 11 Oct. 1983
(Contract W-7405-eng-36)
(DE84-001727; LA-UR-83-3072; CONF-8310177-2) Avail: NTIS HC A02/MF A01

The two-phase flow program is directed at understanding the hydrodynamics of two-phase flows. The two-phase flow regime is characterized by a series of flow patterns that are designated as bubble, slug, churn, and annular flow. Churn flow receives very little scientific attention. This lack of attention cannot be justified because calculations predict that the churn flow pattern will exist over a substantial portion of the two-phase flow zone in producing geothermal wells. The University of Houston is experimentally investigating the dynamics of churn flow and is measuring the holdup over the full range of flow space for which churn flow exists. These experiments are being conducted in an air/water vertical two-phase flow loop. Brown University constructed and is operating a unique two-phase flow research facility specifically designed to address flow problems of relevance to the geothermal industry. An important feature of the facility is that it is dedicated to two-phase flow of a single substance (including evaporation and condensation) as opposed to the case of a two-component two-phase flow. This facility can be operated with horizontal or vertical test sections of constant diameter or with step changes in diameter to simulate a geothermal well profile. DOE

N84-15512# European Space Agency, Paris (France).
FLUID THERMODYNAMICS
Robert Legendre Oct. 1983 71 p Transl. into ENGLISH of "Thermodyn. des Fluides" rept. ONERA-NT-1982-1 ONERA, Paris, 1982
(ESA-TT-778; ONERA-NT-1982-1) Avail: NTIS HC A04/MF A01

The state of a fluid system consisting of one fluid or a mixture of fluids is discussed. Heat, enthalpy and internal energy are defined. Heat engines and energy conservation are considered. Entropy of a two parameter system; Carnot's law; irreversible cycles; and thermodynamic potentials are introduced.
Author (ESA)

N84-15513# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
SOME NOTES ON 3-DIMENSIONAL TURBULENT BOUNDARY LAYER DATA AND TURBULENCE MODELING
B. vandenBerg 26 Apr. 1982 21 p refs Presented at IUTAM Symp. on Three-Dimensional Turbulent Boundary Layers, Berlin 29-31 Mar. 1982
(NLR-MP-82007-U) Avail: NTIS HC A02/MF A01

Three-dimensional turbulent boundary layer experiments on the direction of the measured turbulent shear stress are summarized. Data indicate that turbulent shear stress magnitude and direction are considerably affected by flow three-dimensionality. History effects can dominate the turbulence development in the outer region of the boundary layer. Investigation of the pressure-strain term in the turbulence transport equations indicates that the large effects found in three-dimensional boundary layers can be explained, when assuming for the modeling of that term a negative correlation between the fluctuating static pressure and kinetic energy. Author (ESA)

N84-15514 Stanford Univ., Calif.
IMPROVED TURBULENCE MODELS BASED ON LARGE EDDY SIMULATION OF HOMOGENEOUS, INCOMPRESSIBLE TURBULENT FLOWS Ph.D. Thesis
Jorge Bardina 1983 191 p
Avail: Univ. Microfilms Order No. DA8320678

The physical bases of large eddy simulation and the Subgrid scale modeling it employs are studied and a scale-similarity model for the subgrid-scale turbulent Reynolds stresses was developed: "Exact" tests of this model based on results of full simulations of homogeneous turbulent flows show that it correlates well with the subgrid-scale Reynolds stresses but does not correlate well with eddy viscosity models. A "defiltering" method for large eddy simulation was also developed which can predict accurately the full turbulent kinetic energy from the properties of large eddies. The effects of system rotation on isotropic turbulence, large eddy simulations of homogeneous shear flows and large eddy simulations of homogeneous shear flows with system rotaton are discussed.
Dissert. Abstr.

N84-15515 Illinois Univ., Chicago.
AN EXPERIMENTAL STUDY OF STEADY AND PULSATING HEAT TRANSFER IN CURVED TUBES Ph.D. Thesis
Saeed Manafzadeh 1983 212 p
Avail: Univ. Microfilms Order No. DA8320626

Local measurements of the heat transfer coefficients inside curved tubes were made for air and distilled water. Two experiments are described for Prandtl numbers from 0.7 to 6 and Reynolds numbers up to 25.000. In the first experiment, using air, a 10 foot straight section is followed by a 10 foot curved section, and in the second experiment, using distilled water, the straight section is followed by a 21 foot helically coiled tube. The expected increase in Nusselt number is obtained in the curved section. Of interest in the transition region between straight and curved sections, where a development regime occurs as the secondary flows are established. Here the Nusselt number is found to oscillate, for both laminar and turbulent flows. The nature of the oscillation is very much dependent on the Dean number. New correlations for Nusselt number are proposed for both laminar and turbulent flow regimes. A significant new phenomenon, 'resonance', is evident in the skin

friction and heat transfer results at low frequencies of oscillation.
Dissert. Abstr.

N84-15516 Rochester Univ., N. Y.
INSTABILITY AND TRANSITION IN THE BOUNDARY LAYER Ph.D. Thesis
Peng-Hong Koh 1983 188 p
Avail: Univ. Microfilms Order No. DA8321678

A theoretical model has been developed to describe the different stages of development in the transition of an incompressible laminar flow to its turbulent stage along a flat plate boundary. The transition is modelled as a three stage, sequential event that begins with the two dimensional Tollmein-Schlichting (T-S) wave disturbance. This is followed by the appearance of a longitudinal counterrotating vortex disturbance. The final stage of the transition is characterized by the appearance of the familiar wedge-shaped turbulent 'bursts'. The first phase of the analysis involves the search for the saturation amplitude for the largest amplitude T-S waves for Reynolds numbers from 290 to 1160. A modified Stuart-Watson asymptotic method is used to obtain the neutra surface for the finite amplitude two dimensional self-excited traveling wave disturbance. This neutral surface is defined in the three-parameter space of Reynolds number (R), wavenumber and limiting amplitude (A) characteristics of the disturbance.
Dissert. Abstr.

N84-16038*# Alabama Univ., Huntsville. Dept. of Physics and Astronomy.
A STUDY OF ACCRETION IN COMPACT SOURCES: DISK PRECESSION AND JET HELICITY
Philip E. Hardee *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 39 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20D

N84-16043*# Middle Tennessee State Univ., Murfreesboro. Dept. of Chemistry and Physics.
A REPORT ON SUPERFLUID HELIUM FLOW THROUGH POROUS PLUGS FOR SPACE SCIENCE APPLICATIONS
Franklin Curtis Mason *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 20 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20D

N84-16049*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
A NUMERICAL INVESTIGATION OF THE MULTIPLE VORTEX PHENOMENON: VORTEX NUMBER AND STRUCTURE AS A FUNCTION OF SWIRL RATIO
David R. Smith *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 28 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N84-15517# Defence Research Information Centre, Orpington (England).
INVESTIGATIONS ON THE REPRODUCIBILITY OF THE RESULTS OF DROP WEIGHT TESTS BY THE METHOD OF W. S. PELLINI
R. Helbig 25 Oct. 1983 16 p Transl. into ENGLISH from Stahl Eisen (West Germany), v. 100, no. 25-26, 1980 p 1560-1565 (BLL-DRIC-T-6970-(3623.66); BR89447) Avail: British Library Lending Div., Boston Spa, Engl.

Drop weight tests were performed in seven laboratories on three steels, normalized fine grained structural steel St E 36, air-quenched and tempered creep resistant fine grained structural steel 15 Ni Cu Mo Nb5, and water quenched and tempered steel 2O Mn Mo Ni 55. Scatters around plus or minus 10K were determined for the NDT temperature values, when the specimens were manufactured according to the specifications of the Stahl-Eisen-Pruefblatt 1325. These values were reduced to plus or minus 5K when methods were used to restrict the heat input during crack initiation on the 15 Ni Cu Mo Nb 5 steel. The influence of specimen preparation on scatter was investigated. Author

N84-15518 Stanford Univ., Calif.
ALL-FIBER GYROSCOPE WITH OPTICAL-KERR-EFFECT COMPENSATION Ph.D. Thesis
Ralph Alan Bergh 1983 133 p
Avail: Univ. Microfilms Order No. DA8320692

The fiber-optic gyroscope is relatively new, and potentially important, type of rotation sensor. It consists largely of a loop interferometer which, for the purpose of increasing the rotation sensitivity, includes a coiled single-mode fiber on the order of 1 km in length. Unfortunately, the use of the fiber in the interferometer causes, along with the benefits, measurement errors. Since the fiber parameters are sensitive to the environment, these errors tend to vary in time, and contribute drift and noise to the signal. Much of the research on this subject to date has been involved in identifying the error sources, and in designing the system to reduce their effect on the signal. This dissertation presents contributions which, in combination with many others, have lead to fiber gyroscopes with inertial-navigations-grade performance at low rotation rates. Dissert. Abstr.

N84-15519*# National Aeronautics and Space Administration, Washington, D. C.
RECORDING AND REPRODUCTION OF MICROWAVE HOLOGRAMS USING A SCANNING PROCEDURE AND THEIR SUBSEQUENT OPTICAL PROCESSING
J. Hetsch Oct. 1983 12 p refs Transl. into ENGLISH from Kleinheubacher Ber. (West Germany), v. 26, 1983 p 51-557 Presented at the Intern. Union of Radio Sci. and Nachrichtentechnische Gesellschaft, Gemeinsame Tagung, Kleinheubach, West Germany, 4-8 Oct. 1982 Original language document was announced as A83-23379 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3541)
(NASA-TM-77349; NAS 1.15:77349) Avail: NTIS HC A02/MF A01 CSCL 14B

Intensity distributions in nonoptical wave fields can be visualized and stored on photosensitive material. In the case of microwaves, temperature effects can be utilized with the aid of liquid crystals to visualize intensity distributions. Particular advantages for the study of intensity distributions in microwave fields presents a scanning procedure in which a microcomputer is employed for the control of a probe and the storage of the measured data. The present investigation is concerned with the employment of such a scanning procedure for the recording and the reproduction of microwave holograms. The scanning procedure makes use of an approach discussed by Farhat, et al. (1973). An eight-bit microprocessor with 64 kBytes of RAM is employed together with a diskette storage system. G.R.

N84-15520*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
ON 3He BOLOMETER SYSTEMS Final Technical Report
James R. Houck Nov. 1983 10 p
(Grant NsG-7324)
(NASA-CR-175325; NAS 1.26:175325) Avail: NTIS HC A02/MF A01 CSCL 14B

A 3He cryostat which was constructed to cool a germanium bolometer for use as an infrared detector at submillimeter wavelength is discussed. The system had better sensitivity than

any other existing system for these wavelengths; the system could be improved if better optical coupling could be achieved between the bolometer and the incoming photon stream. Considerable effort was expended to improve this coupling. Even the best results however, fell short of an ideal system by a factor of nearly 5 in coupling efficiency. E.A.K.

N84-15521*# Texas Univ., Austin. Center for Aeronautical Research.
MULTISHAKER MODAL TESTING Final Report, Aug. 1980 - Oct. 1983
Roy R. Craig, Jr. Oct. 1983 35 p refs
(Contract NAS8-33980)
(NASA-CR-170952; NAS 1.26:170952; CAR-83-2) Avail: NTIS HC A03/MF A01 CSCL 14B

Procedures for improving the modal modeling of structures using test data and to determine appropriate analytical models based on substructure experimental data were explored. Two related research topics were considered in modal modeling: using several independently acquired columns of frequency response data, and modal modeling using simultaneous multi-point excitation. In component mode synthesis modeling, the emphasis is on determining the best way to employ complex modes and residuals. E.A.K.

N84-15522*# Texas Univ., Austin. Center for Aeronautical Research.
DIGITAL MULTISHAKER MODAL TESTING
Mark Blair and Roy R. Craig, Jr. 1 Dec. 1983 71 p refs
(Contract NAS8-33980)
(NASA-CR-170951; NAS 1.26:170951; CAR-83-1) Avail: NTIS HC A04/MF A01 CSCL 14B

A review of several modal testing techniques is made, along with brief discussions of their advantages and limitations. A new technique is presented which overcomes many of the previous limitations. Several simulated experiments are included to verify the validity and accuracy of the new method. Conclusions are drawn from the simulation studies and recommendations for further work are presented. The complete computer code configured for the simulation study is presented. Author

N84-15523# Army Research Inst. of Environmental Medicine, Natick, Mass.
DEVELOPMENT AND ASSESSMENT OF THE MONARK CYCLE ERGOMETER FOR ANAEROBIC MUSCULAR EXERCISE
Frank A. Frederick, Richard C. Langevin, Jose Miletti, Michael Sacco, and Michelle M. Murphy Jul. 1983 26 p
(DA Proj. 3E1-62777-A-879)
(AD-A133173; USARIEM-T-6/83) Avail: NTIS HC A03/MF A01 CSCL 06/19

This report describes the system developed by this institute to measure anaerobic power production using the protocol developed at the Wingate Institute in Israel. This test consists of 30 seconds of maximal cycling (or cranking) exercise against a resistance determined according to the body weight of the subject. The system consists of a modified Monark cycle ergometer, a universal counter to monitor flywheel revolutions, and a desktop computer for timing, control, and data processing. The modification of the ergometer for the instantaneous application of resistance is presented. In addition, the methods used to measure pedal revolutions and to calibrate the ergometer, and the analysis of the forces acting on the flywheel are described. Finally, a description of the procedure used in the performance of the Wingate test and a summary of the actual data output are presented. GRA

N84-15524# Army Materials and Mechanics Research Center, Watertown, Mass.
THE POLARIZATION RATIO OF CRYSTAL MONOCHROMATORS Final Report
Laurence D. Jennings Jun. 1983 15 p
(DA Proj. 1L1-61101-A-91-A)
(AD-A133181; AMMRC-TR-83-39) Avail: NTIS HC A02/MF A01 CSCL 14/2

A tabulation of some 40 measured values of the polarization ratio K (a measure of the fractional polarization introduced into an X-ray beam by a crystal monochromator) is presented. The values may be represented through the parameter n given by K = cos n2 theta sub M. The measured values of n cluster around unity and the theoretical rationale for this result is discussed. Possible explanations of outlying values are considered. It is recommended that the polarization ratio of an apparatus be measured using a direct method whenever possible, but methods for estimating a value of K are also given. GRA

N84-15525# Calspan Field Services, Inc., Arnold Air Force Station, Tenn.
DESIGN AND INITIAL OPERATIONAL CHARACTERISTICS OF A SHOCK TUBE-RAMAN SCATTERING CALIBRATION SYSTEM Final Report, 1 Oct. 1981 - 30 Sep. 1982
J. W. L. Lewis, G. A. Kroeger, and M. S. Smith Arnold AFS, Tenn. AEDC Sep. 1983 58 p
(AD-A133251; AEDC-TR-83-33) Avail: NTIS HC A04/MF A01 CSCL 14/2

A shock tube system has been designed and constructed to provide a high-temperature, local thermal equilibrium gas sample for the determination of Raman scattering cross sections. The shock tube was designed for operation over the temperature (T) range of 800 < or = T < or = 4000 K and the number density (n) range of 0.2 < or = n < or = 2.1 amagat. The fabricated steel shock tube was 6.98 m long with a 6.35-cm inner diameter; the driven/driver section length ratio was 1.88. The initial demonstration of a laser Raman-shock tube system for high-temperature cross section and calibration measurements was accomplished. The incident Mach number range of 4 to 5 was studied with the driver gas and N2 as the driven species using a seamless shock tube and the same tube which was retrofitted with a stainless steel tube liner. The Raman spectra obtained with the seamless steel tube revealed effects of rust particles which has been scrubbed from the tube wall. Upon insertion of the stainless steel liner, these effects were reduced to small corrections to the Raman signal. Vibrational Raman spectra of shock-heated N2 were acquired using a frequency-doubled ruby laser, spectrometer dispersion, and a single PMT detection channel. GRA

N84-15526# Computer Sciences Corp., Huntsville, Ala.
SUPPORT FOR THE NAVAL RESEARCH LABORATORY ENVIRONMENTAL PASSIVE MICROWAVE REMOTE SENSING PROGRAM Final Contractor Report
M. F. Hartman 29 Apr. 1983 23 p
(Contract N00173-80-C-0265)
(AD-A133330; CSC/TR-83/6003) Avail: NTIS HC A02/MF A01 CSCL 17/9

This document summarizes the data acquisition, reduction, and processing support CSC provided Code 7911 of the Naval Research Laboratory (NRL) under contract N00173-80-C-0265. The support for the NRL Environmental Passive Microwave Remote Sensing Program included acquisition, implementation, and evaluation of Scanning Multichannel Microwave Radiometer (SMMR) processing algorithms; Environmental Transfer Function development and verification; aircraft data acquisition; and aircraft data processing. Author (GRA)

N84-15527# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
FAR INFRARED RADIOMETRIC SPECTROMETER (FIRRS) Final Report, 5 Nov. 1979 - 30 May 1983
R. A. Bohlander, D. R. Lamm, J. W. Larsen, and M. J. Sinclair Hanscom AFB, Mass. AFGL 29 Jul. 1983 61 p
(Contract F19628-80-C-0031; AF Proj. ILIR)
(AD-A133552; GIT/EES-A-2519; AFGL-TR-83-0137) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report describes a Far Infrared Radiometric Spectrometer (FIRRS) that will be used to survey radiation in the 0.17 to 1.7 mm wavelength band seen looking down from an aircraft. The instrument was built by the Engineering Experiment Station

of Georgia Institute of Technology for the U.S. Air Force Geophysics Laboratory. The instrument is intended for use on an AFGL NKC-135A aircraft. An important initial purpose of the FIRRS will be to determine the effects of atmospheric attenuation and emission. The instrumentation will have two survey functions: (1) It will measure and calibrate the electromagnetic intensity spectrum received when flying over various terrain and atmospheric conditions; (2) Variations in the scene as the aircraft flies along will cause fluctuations in signal, often called clutter, which will also be analyzed. It is important to determine typical levels of background radiation and its clutter to be able to assess future applications of the far infrared wavelength band. After consideration of alternative spectrometer types, two were selected for inclusion in the FIRRS: a rapid-scanning Michelson interferometer, and a series of narrow-band interference filters. These will be used in different regimes determined by the bandwidth in temporal frequency of the clutter. Both will give high thorough efficiency. Radiation will be collected by a telescope with an aperture of 190 mm diameter, and will be detected by liquid helium-cooled bolometers and photoconductors. GRA

N84-15528# IRT Corp., San Diego, Calif.
PROTON ELECTROSTATIC ANALYZER Final Report, 24 Nov. 1980 - 24 Sep. 1982
Roger Judge Hanscom AFB, Mass. AFGL Feb. 1983 113 p (Contract F19628-80-C-0205; AF Proj. 7661)
(AD-A133588; IRT-8203-005; AFGL-TR-83-0081) Avail: NTIS HC A06/MF A01 CSCL 14/2

A multichannel proton electrostatic analyzer has been developed to monitor spacecraft charging by observing changes in the energy spectrum of the proton flux incident on the spacecraft. The analyzer uses electrostatic deflection plates to select incident ions within each energy band for detection by a channel electron multiplier. Command, control, input and output channel and mode selection, count accumulation, and processing are provided by a microprocessor under firmware control from replaceable programmable memories. Author (GRA)

N84-15529# European Space Agency, Paris (France).
STUDY OF THE ONBOARD CALIBRATION EQUIPMENT OF THE HRV CAMERA
J. M. Maisonneuve and M. Dinguirard Oct. 1983 117 p refs Transl. into ENGLISH of "Etude de Dispositifs de Calibration en Vol de la Camera HRV" rept. CERT-5/60047-DERO ONERA, Toulouse, Oct. 1978
(ESA-TT-794; CERT-5/6047-DERO) Avail: NTIS HC A06/MF A01

Flight calibration arrangements of the SPOT satellite HRV camera using: an internal lamp for the different types of calibration, and the Sun for absolute calibration and relative, between band, calibration, were studied. For the internal lamp, an apparatus with direct imaging of the lamp on the detectors is chosen. For the Sun, either mirror or fibers can be used to illuminate the detectors. Author (ESA)

N84-15530# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
CALIBRATION OF AIR-DATA SYSTEMS AND FLOW DIRECTION SENSORS. AGARD FLIGHT TEST TECHNIQUES SERIES, VOLUME 1
J. A. Lawford (Aeroplane and Armament Experimental Establishment, Salisbury, England) and K. R. Nippress (Aeroplane and Armament Experimental Establishment, Salisbury, England) Sep. 1983 67 p refs
(AGARD-AG-300-Vol-1) Avail: NTIS HC A04/MF A01

The calibration of air-data and flow direction measurement systems is discussed. The available flight test calibration methods are described and their applicability, accuracies, and limitations are reviewed. Author

N84-15032# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INSTRUMENTATION AND SIGNAL ANALYSIS
G. Elias *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 14 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

N84-15079# Civil Aviation Authority, Redhill (England). Airworthiness Div.
THE CIVIL AIRCRAFT AIRWORTHINESS DATA RECORDING PROGRAMME
H. D. Ruben *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 18 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15299# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
THE MEASUREMENT OF SURFACE TEXTURE AND ITS CORRELATION WITH FUNCTION
T. O'D. Duggan *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 3-11 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-16053*# Alabama A & M Univ., Normal. Materials and Processing Lab.
LABORATORY AUTOMATION OF A QUADRUPOLE MASS SPECTROMETER
James M. Thompson *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 26 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N84-15531 Stanford Univ., Calif.
SUBPICOSECOND-RELAXATION STUDIES USING TUNABLE-LASER-INDUCED-GRATING TECHNIQUES Ph.D. Thesis
Frederick Peter Trebino 1983 250 p
Avail: Univ. Microfilms Order No. DA8320789

Tunable Laser induced Grating spectroscopy, a type of variable-frequency four-wave-mixing, provides a new and useful approach for the study of ultrafast processes in the frequency domain, with potential application to the measurement of timescales as short as a few femtoseconds. This work examines in detail the Tunable-Laser-Induced-Grating lineshape for excited-state gratings, including saturation effects, using a two-step iterative solution to the rate equations for an n-level system. Lineshapes for phase gratings, also, including those due to the optical Kerr effect, are reviewed. An optically induced grating in an arbitrary material is shown to exhibit a lineshape proportional to the Fourier transform of the material impulse response. The choice of beam geometry is discussed, and simple explicit expression for the Bragg angles in the general three dimensional, nondegenerate four-wave-mixing problem are derived. Previous theoretical and experimental work on the optical-Kerr liquid, carbon disulfide, and the organic dye, malachite green, is summarized, and the results of Tunable-Laser-Induced-Grating experiments using a geometry employing two input frequencies are presented. Dissert. Abstr.

N84-15532 Rochester Univ., N. Y.
DEVELOPMENT OF AN XUV AMPLIFIER Ph.D. Thesis
Yves Gilles Conturie 1982 162 p
Avail: Univ. Microfilms Order No. DA8321656

The feasibility of an XUV amplifier based on the recombination of a laser produced plasma was investigated. Experiments were carried out with a Nd(3+) glass laser generating sub-nanosecond pulses of either IR light (1.054 microns, up to 100 J) or frequency-tripled UV light (0.351 microns up to 60 J). The plasma formed at the surface of a flat target was cooled at an early stage of its expansion by inserting a metallic foil near the target. The cooling

of a dense plasma is known to result in a recombination cascade dominated by collisions, which tend to populate high-lying quantum states of the recombining ion. Dissert. Abstr.

N84-15533 Stanford Univ., Calif.
COHERENT EFFECTS IN LASER SPECTROSCOPY Ph.D. Thesis
Ngai Chuen Wong 1983 175 p
Avail: Univ. Microfilms Order No. DA8320797

Studied of three different coherent effects in laser spectroscopy are presented. (1) The Raman heterodyne effect is a new stimulated Raman process, induced by an optical and a radio frequency field, and is used for detecting steady state or pulsed nuclear magnetic resonance (NMR) in both ground and excited electronic levels. It is demonstrated in the impurity ion praseodymium in a lanthanum trifluroide single crystal, where level splittings, inhomogeneous and homogeneous linewidths and shapes of the hyperfine transitions in ground and excited states are measured with high precision and sensitivity. (2) Optical rotary echoes, the optical analog of rotary spin echoes in NMR, are observed in iodine vapor. Rotary echoes in a two-level system are produced when the coherent driving field undergoes a sudden phase shift. The initial nutation dephases, and then rephases to form an echo following the phase-shifting pulse. A detailed perturbative calculation is performed and predictions are confirmed. Dissert. Abstr.

N84-15534 Wisconsin Univ., Madison.
LASER OPTICAL PUMPING OF SODIUM AND LITHIUM ATOM BEAMS Ph.D. Thesis
Jack Tindaro Cusma 1983 154 p
Avail: Univ. Microfilms Order No. DA8317020

The method of optical pumping with a continuous wave dye laser was used to produce beams of polarized 23Na atoms and polarized 6Li atoms. Optical pumping of a 23Na atom beam using either a multimode dye laser or a single frequency dye laser with a double passed acousto-optic modulator results in electron spin polarizations of 0.70-0.90 and nuclear spin polarizations of 0.75-0.90. Optical pumping of a 6Li atom beam using a single frequency dye laser either with an acousto-optic modulator or with Doppler shift pumping results in electron spin polarizations of 0.77-0.95 and nuclear spin polarizations greater than 0.90. The polarization of the atom beam is measured using either the laser induced fluorescence in an intermediate magnetic field or a 6 pole magnet to determine the occupation probabilities of the ground type fine sublevels following optical pumping. The results of the laser optical pumping experiments agree with the results of a rate equation analysis of the optical pumping process. The use of laser optical pumping in a polarized ion source for nuclear scattering experiments is discussed. Dissert. Abstr.

N84-15535*# Illinois Univ., Urbana. Radio Research Lab.
ANALYSIS OF SHORT PULSE LASER ALTIMETRY DATA OBTAINED OVER HORIZONTAL PATH
K. E. Im, B. M. Tsai, and C. S. Gardner Sep. 1983 79 p refs
(Grant NsG-5049)
(NASA-CR-170612; NAS 1.26:170612; RRL-Pub-526) Avail: NTIS HC A05/MF A01 CSCL 20E

Recent pulsed measurements of atmospheric delay obtained by ranging to the more realistic targets including a simulated ocean target and an extended plate target are discussed. These measurements are used to estimate the expected timing accuracy of a correlation receiver system. The experimental work was conducted using a pulsed two color laser altimeter. Author

N84-15536*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MASER CAVITY SERVO-TUNING SYSTEM Patent Application
Richard L. Sydnor, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 30 Nov. 1983 15 p
(Contract NAS7-100)
(NASA-Case-NPO-15890-1; US-Patent-Appl-SN-556513) Avail: NTIS HC A02/MF A01 CSCL 20E

Two collocated, weakly coupled probes, one loop and one dipole, detect the magnetic and electric fields inside a maser cavity. Signals from the probes are compared in phase, and the signal output from the phase detector is applied to a varactor, the reactance of which is coupled into the cavity by a microwave coupler. Alternatively, the varactor may be placed inside the cavity. Any deviation of phase from 90 deg as detected by the phase detector will then produce an error signal that will change the reactance coupled into the resonant cavity to change its reactance, and thus correct its resonance frequency. An alternative to using two probes is to use a single disk probe oriented to detect both the magnetic and electric fields, and thus provide the error signal directly. NASA

N84-15537*# National Aeronautics and Space Administration. Pasadena Office, Calif.
DISCHARGE CELL FOR OPTOGALVANIC SPECTROSCOPY HAVING ORTHOGONAL RELATIONSHIP BETWEEN THE PROBE LASER AND DISCHARGE AXIS Patent Application
Christopher R. Webster, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 30 Nov. 1983 32 p
(Contract NAS7-100)
(NASA-Case-NPO-16271-1; US-Patent-Appl-SN-556514) Avail: NTIS HC A03/MF A01 CSCL 20E

A method and apparatus for an optogalvanic spectroscopy system is presented. Orthogonal geometry exists between the axis of a laser probe beam and the axis of a discharge created by a pair of spaced apart and longitudinally aligned high voltage electrodes. The electrodes are movable to permit adjustment of the location of a point in the discharge which is to be irradiated by a laser beam crossing the discharge region. The cell dimensions are selected so that the cross section of the discharge region is substantially comparable in size to the cross section of the laser beam passing orthogonally through the discharge region. E.A.K.

N84-15538# Naval Research Lab., Washington, D. C.
ON LASER AIR BREAKDOWN, THRESHOLD POWER AND LASER GENERATED CHANNEL LENGTH Interim Report
A. W. Ali 13 Sep. 1983 22 p
(S0384SL)
(AD-A133211; AD-E000545; NRL-MR-5167) Avail: NTIS HC A02/MF A01 CSCL 20/5

A review is made of the experimental data for the air breakdown threshold power for lasers with wavelength of 0.6954mu to 389mu. A classical theory for the pulsed air breakdown is presented and is utilized to predict threshold power in clean air which is in reasonable agreement with the experimental results. The laser absorption coefficient by the air plasma is discussed in the context of the laser generated channel. It is concluded that one may generate longer channels by controlling the electron density which can be accomplished by controlling the duration of the laser pulse. GRA

N84-15539# Los Alamos Scientific Lab., N. Mex. Physics Branch.
APPLICATION OF TWO-DIMENSIONAL DISCRETE-ORDINATES METHODS TO MULTIPLE SCATTERING OF LASER RADIATION Report, 6 Dec. 1982 - 17 Feb. 1983
A. Zardecki, S. A. W. Gerstl, and J. F. Embury Aberdeen Proving Ground, MD. Army Armament Reserach and Development Command Jun. 1983 30 p
(AF Proj. 1L1-62622-A-552)
(AD-A133258; ARCSL-TR-83022) Avail: NTIS HC A03/MF A01 CSCL 12/1

The discrete-ordinates finite element radiation transport code TWOTRAN is applied to describe the multiple scattering of a laser beam from a reflecting target. For a model scenario involving a 99% relative humidity rural aerosol, the authors compute the average intensity of the scattered radiation and correction factors to the Lambert-Beer law arising from multiple scattering. As their results indicate, two-dimensional x-y and r-z geometry modeling can reliably describe a realistic three-dimensional scenario. Specific results are presented for the two visual ranges of 1.52 and 0.76 km which show that for sufficiently high aerosol

concentrations (e.g., equivalent to V=0.76 km) the target signature in a distant detector becomes dominated by multiply scattered radiation from interactions of the laser light with the aerosol environment. The merits of the scaling group and the delta M approximation for the transfer equation are also explored. GRA

N84-15540# McDonnell-Douglas Research Labs., St. Louis, Mo. Radiation Sciences Dept.
LASER RADAR ANALYSES Final Report, 15 Jul. 1980 - 15 Jul. 1983
J. C. Leader 15 Jul. 1983 54 p
(Contract N60921-79-C-0180; SF32399492)
(AD-A133295; MDC-Q1203) Avail: NTIS HC A04/MF A01 CSCL 20/5

The analyses developed in a previous study (Laser Radar Analyses MDC Q0714, 15 July 1980) are modified and extended to the case of a Cassegrain laser radar receiver. A flexible computer code (LADAR) is documented that permits calculations of the degradation in heterodyne efficiency of a laser radar system that result from phase front distortions produced by target speckle effects and atmospheric turbulence. Illustrative calculations are provided to demonstrate the effects of atmospheric turbulence (for both circular aperture and Cassegrain receivers), and target speckle (conical targets and simulated aircraft are treated) on heterodyne efficiency. Efficiency calculations are also provided for a suggested test panel target to demonstrate the feasibility of using a test configuration to verify the predictions of the efficiency analyses and LADAR computer code. Author (GRA)

N84-15541# KMS Fusion, Inc., Ann Arbor, Mich.
A LOW LOSS QUASIOPTICAL CAVITY FOR A TWO-STAGE FREE ELECTRON LASER (FEL)
S. Von Laven, S. B. Segall, and J. F. Ward (Michigan Univ., Ann Arbor) 25 Aug. 1983 14 p Submitted for publication
(Contract N00014-80-C-0614)
(AD-A133321; KMSF-U1362) Avail: NTIS HC A02/MF A01 CSCL 20/5

A quasioptical cavity consisting of a cylindrical, metallic, overmoded, TE sub 01 waveguide between two spherical end mirrors will be used to contain long-wavelength (approx. 1 mm) pump radiation in a two-stage free electron laser. The major loss mechanism is found to be mode conversion. Two different modified cavities are shown to suffer negligible mode conversion, and two more possible approaches, with low mode conversion and additional advantages, are discussed. Author (GRA)

N84-15542# KMS Fusion, Inc., Ann Arbor, Mich.
LIMITING ENERGY SPREAD AT HIGH LASER INTENSITIES USING PHASE SPACE DISPLACEMENT
H. Takeda and S. B. Segall 25 Aug. 1983 13 p
(Contract N00014-80-C-0614)
(AD-A133322; KMSF-U1360) Avail: NTIS HC A02/MF A01 CSCL 20/5

Phase space displacement is investigated as a method of reducing energy spread in free electron lasers producing long-wavelength (approx. 1 mm) at high laser intensity (approx. 10 to the 7th power - 10 to the 8th power W/sq cm). The technique is described and compared with the more conventional tapered wiggler that traps electrons in decelerating phase space buckets. A band model is developed to describe the movement of electrons around the phase space buckets and estimate the resulting energy spread. The energy spread obtained from the band model is compared with that obtained from a multiparticle computer simulation. Laser gain obtained by bucket capture is found to be comparable to gain obtained by phase space displacement at high intensities but energy spread is a factor of a few lower. GRA

N84-15543# General Electric Co., Philadelphia, Pa. Space Div.
COPPER VAPOR LASER SCALE DEMONSTRATION Final Report, Oct. 1981 - Feb. 1983
T. W. Karras, M. H. Bortner, and C. E. Anderson Feb. 1983 95 p
(Contract N00014-82-C-0057; DARPA Order 3650)
(AD-A133327) Avail: NTIS HC A05/MF A01 CSCL 20/5

A pulsed copper vapor laser has been successfully scaled to 10 cm diameter. A computer simulation model of the pulsed copper vapor laser in both helium and neon buffers was developed and validated. It projects output pulse energy at 510.5 nm of over 0.33 joules and efficiency of over 2.5% from a 10 cm diameter laser running at 200 HZ, in neon. The key to such operation is the decay of ionization and gas heating during the long interpulsed period and the application of high voltage for reliable breakdown. This minimizes skin effect limitations and increases electron temperature. A flexible large bore laser test facility was built using glow discharge heating and burst mode excitation. Preliminary tests with a 4 1/8 in. diameter laser were fully successful. Glow discharges could heat the laser to the 1400 deg C-1500 deg C range and pulsed discharges filled the full bore. Pulse to pulse reproducibility could be achieved at 200 HZ after only two pulses if voltages of 36 KV were applied to the storage capacitor. The specific loading in these tests was several millijoules per cu cm, the range projected by the model as necessary for high energy output. Laser operation was also demonstrated filling essentially the full bore. Estimates of unoptimized output energy in helium were in the range of greater than 70 millijoules, the highest ever reported from a pulsed metal vapor laser. These results were consistent with computer simulations. Measured current and voltage waveforms agreed very closely with computer generated plots.
Author (GRA)

N84-15544# California Univ., Santa Barbara. Quantum Inst.
THEORY OF PULSE PROPAGATION AND COHERENCE IN FREE ELECTRON Final Scientific Report, 2 Dec. 1981 - 30 Nov. 1982
W. B. Colson Nov. 1982 7 p
(Grant AF-AFOSR-0061-81; AF Proj. 2301)
(AD-A133334; AFOSR-83-0783TR) Avail: NTIS HC A02/MF A01 CSCL 20/5

A review was made of various pulse propagation theories and comparison to the Stanford experiment. Quantum noise effects were theoretically derived for free electron lasers in optical resonators and found to be small. Control of the synchrontron instability with selective mirrors was examined. A comprehensive Lagrangian description of the gain surfaces for various free electron laser designs was made. A theory was developed for the electron dynamics and optical wavefronts in Gaussian resonators.
Author (GRA)

N84-15545# Technion - Israel Inst. of Tech., Haifa.
COHERENTLY PUMPED TWO-FREQUENCY LASER-TYPE DEVICES Annual Report
I. R. Senitzky May 1983 15 p
(Contract DAJA37-81-C-0223)
(AD-A133439; AD-E750844) Avail: NTIS HC A02/MF A01 CSCL 20/5

Coherent two-photon pumping of a device in which resonant cavity-modes are coupled to both intermediate transitions of a large number of three level systems is studied further than has been done previously. The dynamics of the three-level system under the influence of two-photon pumping without cavity coupling is shown to exhibit not only spin - 1/2 behavior - the main result of previous investigation - but also spin - 1 behavior. The former occurs for detuning from exact two-photon resonance toward the more strongly coupled intermediate frequency and weak pumping, while the latter occurs for detuning from exact two-photon resonance toward the more weakly coupled intermediate frequency and strong pumping. It is also found that, for certain initial conditions, the level populations remain constant, and no population transfer between levels can be produced by the pumping field.
Author (GRA)

N84-15546# KMS Fusion, Inc., Ann Arbor, Mich.
TWO-STAGE FEL (FREE ELECTRON LASER) PROGRAM
S. B. Segall, H. Takeda, and S. Von Laven 25 Aug. 1983 15 p Presented at the FEL Workshop, Eastsound, Wash., Jun. 1983 Submitted for publication

(Contract N00014-80-C-0614)
(AD-A133508; KMSF-U1359) Avail: NTIS HC A02/MF A01 CSCL 20/5

A review of a two-stage free electron laser research program is presented. The work includes cavity and wiggler magnet design, a study of methods for minimizing electron energy spread at high first stage intensity, and calculations of second stage gain. A quasioptical cavity is proposed to contain the first-stage long-wavelength radiation while permitting transmission of second-stage short-wavelength radiation. A permanent magnet helical wiggler will be used to produce the long-wavelength radiation. At high first stage intensities (approx. 10 to the 8th power W sq cm) the energy spread produced in the wiggler will be > 10%. For the experiment being proposed the beam line and electron collector must be modified to accept this spread. Companion papers in this volume give additional details of the cavity design and minimization of energy spread. Author (GRA)

N84-15547# TRW Energy Systems, Redondo Beach, Calif. Energy Development Group.
PHOTODETACHMENT NEUTRALIZER DEVELOPMENT. LASER-RESONATOR STUDY. VOLUME 1: SUMMARY Final Report
30 Sep. 1983 26 p refs
(Contract W-7405-eng-48)
(DE84-001682; UCRL-15559-Vol-1) Avail: NTIS HC A03/MF A01

The Photodetachment Neutralizer (PDN) concept utilizes a chemical oxygen iodine laser (COIL) system operating in the closed cavity mode which provides a well defined volume filled with laser light was studied. The negative ion beam (D(+)) interacts with the laser photons resulting in a neutralization by photodetachment. The produced neutral beam is used to heat fusion devices. A technology base of the PDN concept was assessed by performing the tasks of: mirror technology assessment, window engineering analysis/technology assessment, and COIL medium modeling with emphasis on PDN issues. DOE

N84-15548# Oak Ridge Gaseous Diffusion Plant, Tenn. Nuclear Div.
DIODE LASER SPECTROPHOTOMETRY FOR MONITORING ACETYLENE ON-LINE IN A LIQUEFACTION PLANT
Wayne L. Maddox and Charles M. Turner 18 Nov. 1983 4 p Presented at the 26th ORNL-DOE Conf. on Anal. Chem. in Energy Technol., Knoxville, Tenn., 11-13 Oct. 1983
(Contract W-7405-eng-26)
(DE84-002117; K/PS-5013-EA; CONF-831025-24) Avail: NTIS HC A02/MF A01

A diode laser source infrared spectrometer has been acquired for use as an on-line monitor for acetylene in the rich (oxygen-enriched) liquid stream of the ORGDP liquefaction plant. The liquefaction plant produces high purity liquid nitrogen. DOE

N84-15674# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF ATMOSPHERIC PRESSURE AND SEA STATE FROM SATELLITES USING SHORT-PULSE MULTI-COLOR LASER ALTIMETERS
Chester S. Gardner, Bin-Min Tsai, and James B. Abshire *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 11 p refs Prepared in cooperation with Illinois Univ., Urbana (For primary document see N84-15646 06-43)
(Grant NsG-5049)
Avail: NTIS HC A17/MF A01 CSCL 20E

N84-16026*# Auburn Univ., Ala. Dept. of Physics.
HYDROGEN IGNITION FOR LASER PROPULSION
Raymond F. Askew *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 22 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N84-15549# Defence Research Information Centre, Orpington (England).
WELDING DEFORMATIONS AND RESIDUAL STRESSES DUE TO CIRCUMFERENTIAL WELDING OF CYLINDRICAL SHELLS AND HEMISPHERICAL END PLATES
Y. Fujita, T. Nomoto, and H. Hasegawa 7 Oct. 1983 24 p refs TRansl. into ENGLISH from J. Jap. Welding Soc. (Japan), v. 50, no. 8, 1981 p 731-736
(BLL-DRIC-T-6968-(3623.66); BR89448) Avail: British Library Lending Div., Boston Spa, Engl.

The residual stresses and deformations due to circumferential welding of cylindrical or spherical shells are a key problem affecting the stress corrosion cracking and collapse strength of pipe structures or pressure vessels. The stresses in these structures differ from those in a butt welded flat plate, due not only to hoop stress but also to bending stress in the longitudinal direction. This bending stress arises from the radial displacement due to circumferential shrinkage of the welds. This paper discusses the welding deformations and residual stresses due to circumferential welding of cylindrical shells and hemispherical and plates. A one dimensional thermal elastic-plastic analysis using the Rayleigh-Ritz method is applied to the axisymmetric thermal stress problems of thin cylindrical and spherical shells. Conclusions are drawn regarding the influence of shell size and welding heat input on welding deformations and residual stresses, and of the effectiveness of proposed design charts. Author

N84-15550# Central Electricity Generating Board, London (England).
INFLUENCE OF Ar + CO2 SHIELDING ON THE COMPOSITION OF A Cr-Mo-V WELD
M. Waluk 8 Nov. 1983 17 p refs Transl. into ENGLISH from Przeglad Spawalnictwa (Poland), v. 31, no. 8, 1979 p 5-8
(BLL-CE-Trans-8000-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Many attempts are now being made to employ welding the a consumable electrode shielded with gas mixtures. Failures of welded joints in power plants have engendered greater interest in certain problems, in particular: creep, graphitization, spheroidization of cementite, phase changes of metals, and diffusion, Investigations of welds in type Cr-Mo and Cr-Mo-V creep-resisting low-alloy steels showed that with the majority of covered electrodes manufactured for arc welding, the deposited metal has much lower properties compared with the parent metal. The losses arising from shutdowns of power units caused by failures are really substantial, amounting to about 240 dollars per 1 MW per 24 h, which means a daily loss of 48,000 dollars in the case of a 200 MW unit. Unit power of 200-215 MW is in fact prevalent in Polish power engineering. B.W.

N84-15551 Huffman (Paul R.), Inc., Pemberville, Ohio.
RECYCLING THE KINETIC ENERGY OF AN AUTOMOBILE Final Technical Report
Paul R. Huffman 8 Nov. 1982 28 p
(Contract DE-FG02-81R5-10326)
(DE83-004201; DOE/R5-10326/2) Avail: NTIS HC A03

Conversion of the kinetic energy of a moving automobile into potential energy was investigated. A hydraulic accumulator releases energy when a moving automobile is decelerated. The stored energy is then used to reaccelerate the moving automobile, and 60% of the energy is recycled. A 1981 General Motors Chevette with standard stick shift transmission was converted to hydrostatic drive with the use of a variable displacement hydraulic piston type pump and a similar hydraulic motor. The power train was simple and worked well. Hydraulic pressure of 3000 psi was generated in the accumulators. The accumulators lose their pressure much more rapidly than the displacement of the motor

would use. It is suggested that this is caused by an internal leak. DOE

N84-15552*# National Aeronautics and Space Administration, Washington, D. C.
DESIGN PROCEDURES FOR COMPRESSOR BLADES
H. Starken Jul. 1983 11 p Transl. into ENGLISH of "Entwurfsverfahren fuer Verdichterschaufeln" rept. DFVL-Nachrichten, Cologne, Nov. 1981 p 49-51 Original language document was announced as A82-17135 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3541)
(NASA-TM-77085; NAS 1.15:77085) Avail: NTIS HC A02/MF A01 CSCL 21E

The conventional methods for the design of the blades in the case of axial turbomachines are considered, taking into account difficulties concerning the determination of optimal blade profiles. These difficulties have been partly overcome as a consequence of the introduction of new numerical methods during the last few years. It is pointed out that, in the case of the subsonic range, a new procedure is now available for the determination of the form of blade profile on the basis of a given velocity distribution on the profile surface. The search for a profile form with favorable characteristics is consequently transformed into a search for a favorable velocity or pressure distribution on the blade. The distribution of velocities depends to a large degree on the characteristics of the profile boundary layers. The considered concept is not new. However, its practical implementation has only recently become possible. The employment of the new design procedure is illustrated with the aid of an example involving a concrete design problem. G.R.

N84-15553*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL DETERMINATION OF GAP FLOW-CONDITIONED FORCES AT TURBINE STAGES AND THEIR EFFECT ON THE RUNNING STABILITY OF SIMPLE ROTORS Ph.D. Thesis
Raimund Wohlrab Oct. 1983 184 p refs Transl. into ENGLISH of the mono. "Experimentelle Ermittlung Spaltstromungsbedingter Krafte an Turbinestufen und Deren Einfluss auf die Laufstabilitat Einfacher Rotoren" Munich, Technische Univ., 1975 p 1-161 Original language document was announced as A76-42648 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77293; NAS 1.26:77293) Avail: NTIS HC A09/MF A01 CSCL 21E

Instabilities in turbine operation can be caused by forces which are produced in connection with motions involving the oil film in the bearings. An experimental investigation regarding the characteristics of such forces in the case of three typical steam turbine stages is conducted, taking into account the effect of various parameters. Supplementary kinetic tests are carried out to obtain an estimate of the flow forces which are proportional to the velocity. The measurements are based on the theoretical study of the damping characteristics of a vibrational model. A computational analysis of the effect of the measured fluid forces on the stability characteristics of simple rotor model is also conducted. G.R.

N84-15554*# General Motors Corp., Indianapolis, Ind. Engineering Dept.
ADVANCED GAS TURBINE (AGT) TECHNOLOGY DEVELOPMENT Semiannual Report
May 1983 49 p refs
(Contracts DEN3-168; DE-AI01-77CS-1040)
(NASA-CR-168235; DOE/NASA/0168-6; NAS 1.26:168235; EDR-11443) Avail: NTIS HC A03/MF A01 CSCL 21A

A 74.5 kW (100 hp) automotive gas turbine was evaluated. The engine structure, bearings, oil system, and electronics were demonstrated and no shaft dynamics or other vibration problem were encountered. Areas identified during the five tests are the scroll retention features, and transient thermal deflection of turbine backplates. Modifications were designed. Seroll retention is addressed by modifying the seal arrangement in front of the gasifier turbine assembly, which will increase the pressure load on the scroll in the forward direction and thereby increase the retention forces. the backplate thermal deflection is addressed by geometric changes and thermal insulation to reduce heat input. Combustor rig proof testing of two ceramic combustor assemblies was completed. The combustor was modified to incorporate slots and reduce sharp edges, which should reduce thermal stresses. The development work focused on techniques to sinter these barrier materials onto the ceramic rotors with successes for both material systems. Silicon carbide structural parts, including engine configuration gasifier rotors (ECRs), preliminary gasifier scroll parts, and gasifier and power turbine vanes are fabricated. E.A.K.

N84-15555*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF A HIGH-FREQUENCY STIRLING CYCLE COMPRESSOR FOR CRYOGENIC COOLING IN SPACE
Mohan D. Deshpande (Catholic Univ.) and Philip A. Studer Jul. 1983 110 p refs
(Contract NAS5-27343)
(NASA-TM-85066; NAS 1.15:85066; REPT-83F0228) Avail: NTIS HC A06/MF A01 CSCL 13I

The dynamics of a compressor piston with a nonlinear gas spring (provided by the gas compression force) operating in a self resonant mode were analyzed to permit computer simulation. The intent was to increase the operating frequency to 270 Hz and to design a dynamically balanced compressor. These changes, which would allow greater specific power and eliminate a separate balancing device, are highly advantageous for cryogenic cooling in space. A short stroke large area piston allows a drive system to use electromagnetically coupled pistons with stationary excitation coils. This configuration and some test results are included. The performance of the drive system was studied analytically and computationally for operation under resonance conditions necessary for high efficiency. An acoustically tuned displacer is assumed. The analysis and computer model that was developed should allow optimization and miniaturization. M.G.

N84-15556# Naval Ship Research and Development Center, Bethesda, Md. Ship Materials Engineering Dept.
INTERACTIVE MECHANISMS OF SLIDING-SURFACE BEARINGS
Thomas L. Daugherty and Coda H. T. Pan (Columbia Univ.) Aug. 1983 140 p
(F61541)
(AD-A133127; DTNSRDC-82/119) Avail: NTIS HC A07/MF A01 CSCL 11/8

This report adapts the theory of hydrodynamic lubrication to include surface roughness effects and asperity interactions. This theory becomes a means of studying the behavior of sliding-surface bearings in transition from hydrodynamic into mixed lubrication. A model problem, in the form of a crowned tilt-pad bearing with longitudinal roughness, was solved. In treating the model problem, end-leakage was neglected and a constant lubricant viscosity was assumed. Use of numerical computational methods could readily remove these restrictions. In real operating environments of ship components and shipboard machinery, the lubrication process is made more complex by thermoelastohydrodynamic effects and the likely occurrence of film striation. Because these complicated phenomena are only qualitatively understood, no adequate or comprehensive method exists for designing critical machine components such as face seals, elastomeric sterntube bearings, rudder stock, diving plane bearings, and main shaft thrust bearings. This report is part of a comprehensive plan to develop a better understanding of the interactive wear mechanisms of sliding surfaces. The theoretical basis is the application of Reynold's equation to the mixed lubrication regime. A closed-form solution of Reynold's equation applied to a crowned tilt-pad thrust bearing in transition from the hydrodynamic to the mixed lubrication region is presented to demonstrate some of the principles of this approach. The concepts developed are applicable to a wide variety of bearings and seals. GRA

N84-15557# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
EVALUATION OF TYPE 2 FAST PACKS FOR ELECTROSTATIC DISCHARGE PROPERTIES Final Report
Alfred J. Sicard Aug. 1983 11 p
(AD-A133158; PTPT-83-R-04) Avail: NTIS HC A02/MF A01 CSCL 15/5

A commercially available cushioned, fiberboard pack was evaluated for both its electrostatic protection properties as well as its shock and vibration characteristics with regard to the critical protection of sensitive electronic components. The cushioning performance of the pack was compared with that of a similar size standard Type II Fast Pack (PPP-B-1672). The results of this evaluation indicated that the pack provided cushioning protection which, on average, was comparable to that obtained with the standard Type II Fast Pack. Using as a reference base, the static charge built up on a standard Type II Fast Pack, which contains no antistatic treated materials, it was determined that the pack having electrostatic protection properties avoided the development of electrostatic fields which measured as high as 4.5 KV in the standard pack. Other concepts are also currently being considered for providing electrostatic protection for the Type II Fast Pack. These include the use of conductive carbon impregnated polyurethane foams as well as foams treated with antistatic materials. GRA

N84-15558# Materials Research Labs., Ascot Vale (Australia).
PERMEABILITY OF FLEXIBLE MATERIALS USED IN FUEL STORAGE TANKS. PART 2: A METHOD OF MEASUREMENT AND PRELIMINARY RESULTS
Robert J. Mathews Dec. 1982 24 p
(AD-A133451; MRL-TN-460-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 13/4

A method has been developed for the determination of the permeability of flexible tank fabrics to liquid fuels. The methods, which employs a mass spectrometer, enables the permeabilities of fabrics at 20C and at elevated temperatures to be assessed using a test liquid of 70% iso-octane and 30% toluene. Test results have been compared with results obtained using the standard gravimetric method and recommendations have been made for future work. Author (GRA)

N84-15559# Sonex Research, Inc., Annapolis, Md.
NAHBE (NAVAL ACADEMY HEAT BALANCED ENGINE) m151 RETROFIT EVALUATION Final Report, 1 Jul. 1981 - 30 Jun. 1983
A. A. Pouring and C. C. Failla 15 Aug. 1983 75 p
(Contract N00014-81-M-0058)
(AD-A133475; SONEX-838151) Avail: NTIS HC A04/MF A01 CSCL 21/7

NAHBE (Naval Academy Heat Balanced Engine) state of the art technology was applied to a standard military four cylinder M-151-1/4 Ton Utility Truck (Jeep) to demonstrate retrofitted versus standard engine performance in waterbrake and chassis dynamometers as well as on the road. Chassis dyno results showed a maximum possible retrofit improvement in miles per gallon of 21.3% at 55 mph and 35.4% at 30 mph. Waterbrake dyno results show higher improvements at low throttle settings indicating that further improvement on the road is possible by proper coordination of fuel, air and spark timing. NAHBE exhaust gas temperatures are on the order of 200 F lower for equal throttle settings and RPM with maximum temperatures equal to or below the lowest standard engine temperatures. The spread in temperature between max-min at a given speed is reduced by a factor of 3-4. Waterbrake dyno emission levels of CO, HC are reduced significantly (NOx not available at the time); chassis dyno emissions for steady state and transient conditions include NOx. No EGR, air pump or catalytic converter were used. Much flatter torque curves were observed at all throttle settings with appreciable increases noted at part throttle shift point RPM. GRA

N84-15560# Oak Ridge National Lab., Tenn.
STIRLING ENGINES WITH CONTROLLED EVAPORATION OF A TWO-PHASE TWO-COMPONENT WORKING FLUID
C. D. West 1983 11 p refs Presented at the 18th Intersoc. Energy Conversion Eng. Conf., Orlando, Fla. 21-26 Aug. 1983
(Contract W-7405-eng-26)
(DE83-017284; CONF-830812-59) Avail: NTIS HC A02/MF A01

The specific power of a Stirling engine can be greatly increased by evaporating liquid in the hot expansion-space region. Theory and experiment have indicated that a twofold to threefold increase is possible. This paper shows that by controlling: (1) the rate at which the liquid is evaporated into the expansion cylinder; and (2) the phase of the cycle at which the evaporation takes place, still larger increases may be achieved under quite reasonable operating conditions. Successful application of this principle would make it practicable to operate simple low-pressure engines with moderate hot-end temperatures and perhaps even with the very low temperatures associated with simple nontracking solar collectors and with certain reject heat streams. DOE

N84-15561# Los Alamos Scientific Lab., N. Mex.
NUMERICAL EXPERIMENTS WITH CONCHAS-SPRAY: COMPRESSION STROKE OF AN EXTERNAL CHAMBER DIESEL ENGINE
L. D. Cloutman Sep. 1983 24 p refs
(Contract W-7405-eng-36)
(DE84-002321; LA-9871-MS) Avail: NTIS HC A02/MF A01

The CONCHAS-SPRAY computer program was used to simulate the compression stroke of an external chamber diesel engine. It is suggested that the strongest fluid motions in the external chamber occur at the time fuel is injected, the peak temperature is 7% below an idealized adiabatic prediction, and the peak pressure is 10% lower. An example of a simple procedure for generating grids for complex engine geometries is shown. DOE

N84-15562# National Centre of Tribology, Risley (England). European Space Tribology Lab.
THERMAL CONDUCTANCE AND TORQUE OF THIN SECTION FOUR-POINT CONTACT BALL BEARINGS IN VACUUM
R. A. Rowntree and M. J. Todd Paris ESA Mar. 1983 57 p refs
(Contract ESTEC-4099/791/NL-PP(SC))
(ESA-ESTL-54; ESA-CR(P)-1772) Avail: NTIS HC A04/MF A01

Ball bearings for the L-SAT antenna pointing mechanism (APM) were tested in vacuum with external diameter clearance (i.e., free fit rings) and held in-situ with clamp rings. The influence of speed, temperature, internal preload, axial ring clamping force, lubricant and cage type was examined. As the inner race becomes warmer than the outer, the conductance increases linearly with the temperature difference, whereas the increase in torque is almost a square law relation. With a colder inner race, the bearing develops internal diametral clearance and thus gives low conductance and a small constant torque. Bearing torque and conductance are also shown to be dependent on axial clamping force, internal preload and lubricant quantity. Hysteresis effects of temperature on conductance and torque, and the contribution of the cage to the overall bearing torque are noted. By suitable selection of internal preload and clamping force, the design requirements for L-SAT APM bearings can be achieved. Author (ESA)

N84-15563# National Centre of Tribology, Risley (England). European Space Tribology Lab.
[ACTIVITIES REPORT OF THE EUROPEAN SPACE TRIBOLOGY LABORATORY (ESTL)] Progress Report, 1980 - 1981
A. J. Walton Paris ESA May 1983 16 p refs
(Contract ESTEC-4099/79/NL-PP)
(ESA-ESTL-55; ESA-CR(P)-1791) Avail: NTIS HC A02/MF A01

Thermal vacuum tests on spacecraft solar array and antenna pointing mechanisms, and stepping and DC motors are summarized. Tribology aspects of a very low vapor pressure oil, slip ring/brush performance; gears for satellite mechanisms; friction and wear properties of commercially available solid lubricant coatings; molybdenum disulfide lubricated bearings; and four-point-contact bearing evaluation are described. Lubrication of lead ion-plated bearings for satellites; space sled bearings/wheels; and

cables for instrument pointing system platforms are discussed.
Author (ESA)

N84-15473# Brown, Boverie und Cie, A.G. Baden (Switzerland).
THE DESIGN OF MODERN LOW PRESSURE (LP) STEAM TURBINES
A. Roeder *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 47 p (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

N84-15474# Genoa Univ. (Italy).
TURBINE AERODYNAMIC DESIGN USING THROUGH-FLOW THEORY. MERIDIONAL THROUGH-FLOW CALCULATION
M. Troilo *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 44 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

N84-15475# Ansaldo S.p.A., Genoa (Italy). Power Generation Div.
AERODYNAMICS AND STEAM WETNESS FRACTION OF A MULTISTAGE TURBINE. COMPARISON OF PREDICTION WITH EXPERIMENTAL DATA
A. Accornero and L. Maretto *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 26 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

N84-15476# Central Electricity Research Labs., Leatherhead (England).
MEASUREMENTS IN STEAM TURBINES
M. J. Moore *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers 1983 39 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

N84-15478# Westinghouse Electric Corp., Philadelphia, Pa.
TRENDS IN STEAM TURBINE DESIGN, TESTING AND MANUFACTURING
David H. Evans *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 41 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

N84-15479# Cambridge Univ. (England).
A METHOD OF CALCULATING FULLY THREE DIMENSIONAL INVISCID FLOW THROUGH ANY TYPE OF TURBOMACHINE BLADE ROW
J. D. Denton *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 40 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

N84-15480# Cambridge Univ. (England).
A REVIEW OF CURRENT RESEARCH ACTIVITY ON THE AERODYNAMICS OF AXIAL FLOW TURBINES
J. D. Denton *In* Von Karman Inst. for Fluid Dynamics Aerothermodyn. of Low Pressure Steam Turbines and Condensers, Vol. 1 1983 31 p refs (For primary document see N84-15472 06-34)
Avail: NTIS HC A15/MF A01

N84-16034*# Auburn Univ., Ala. Dept. of Mathematics.
LINEAR AND NONLINEAR ASPECTS OF ROTORDYNAMICS
William B. Day *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 22 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 13I

N84-16047*# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
SENSOR CONTROL OF ROBOT ARC WELDING
Fred R. Sias, Jr. *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 56 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N84-15564# British Library Lending Div., Boston Spa (England).
INTEGRATED EVALUATION OF THE QUALITY OF STEEL CABLE WIRE
G. S. Gun, G. Sh. Rubin, E. A. Pudov, and G. A. G. A. Bronnikova 7 Oct. 1983 5 p refs Transl. into ENGLISH from Stal (USSR), no. 1, 1983 p 56-57
(BLL-M-35267-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The articles gives the mathematics used for determining the complex index of wire production quality. The index can be used in finding the quality of particular products from separate departments, shops or works.
Author

N84-15565*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
INPUT-OUTPUT CHARACTERIZATION OF AN ULTRASONIC TESTING SYSTEM BY DIGITAL SIGNAL ANALYSIS Final Report
Hira Karaguelle, Sampson S. Lee, and James Williams, Jr. Washington NASA Jan. 1984 46 p refs
(Grant NAG3-328)
(NASA-CR-3756; E-1873; NAS 1.26:3756) Avail: NTIS HC A03/MF A01 CSCL 14D

The input/output characteristics of an ultrasonic testing system used for stress wave factor measurements were studied. The fundamentals of digital signal processing are summarized. The inputs and outputs are digitized and processed in a microcomputer using digital signal processing techniques. The entire ultrasonic test system, including transducers and all electronic components, is modeled as a discrete-time linear shift-invariant system. Then the impulse response and frequency response of the continuous time ultrasonic test system are estimated by interpolating the defining points in the unit sample response and frequency response of the discrete time system. It is found that the ultrasonic test system behaves as a linear phase bandpass filter. Good results were obtained for rectangular pulse inputs of various amplitudes and durations and for tone burst inputs whose center frequencies are within the passband of the test system and for single cycle inputs of various amplitudes. The input/output limits on the linearity of the system are determined.
E.A.K.

N84-15566# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
AUTOMATIC INSPECTION FOR PRINTED WIRING Interim Report
Robert Thibadeau, Mark Friedman, and John Seto 3 Oct. 1982 18 p Presented at the Inst. for Interconnecting and Package Electron. Circuits, 3 Oct. 82, San Diego, Calif.
(AD-A133328; CMU-RI-TR-82-16) Avail: NTIS HC A02/MF A01 CSCL 14/2

Automatic visual inspection of PWBs(Printed Wiring Boards) is a technology which is just about to arrive. A new machine will appear on the factory floor which actually looks at what it is doing. The arrival of this machine has been marked by years of research, and it is likely that years more of research will be invested in its perfection. But for now, a practical and economically rewarding device is available. As in any new technology, it is important to consider the long-term goals as well as the short-term rewards. PWB inspection stations primarily serve quality control functions, but they hold great potential in serving process control functions.

We are on the verge of having devices which can bring tireless and intelligent vision to the process of PWB fabrication. GRA

N84-15567# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
RESEARCH IN SOME APPLIED, AND THE MODELLING ASPECTS OF, RELIABILITY THEORY Final Report, 25 Jan. 1980 - 30 Apr. 1983
Nozer D. Singpurwalla 12 Sep. 1983 15 p
(Contract DAAG29-80-C-0067)
(AD-A133424; GWU/IRRA/TR-83/3; ARO-17074.13-MA) Avail: NTIS HC A02/MF A01 CSCL 12/1

This is a final report which summarizes the research conducted on a large class of topics motivated by reliability and life testing problems. The topics covered include, in alphabetical order, accelerated life tests, Bayesian bioassay, failure rate estimation, goodness of fit testing, Kalman filtering, life testing, quantile estimation, reliability growth monitoring, software reliability, sequential life testing, simulation of Gaussian processed, and time series analysis of reliability data. Most of the work undertaken has appeared in print as journal articles, and this is referenced. The other work is currently under review for various professional journals. GRA

N84-15568# North Carolina Univ., Chapel Hill.
MOMENT ESTIMATORS OF DEFECT PATTERN FREQUENCIES, ALLOWING FOR INSPECTION ERROR
Norman L. Johnson and Samuel Kotz (Maryland Univ., College Park) Sep. 1983 12 p
(Contract N00014-81-K-0301)
(AD-A133487; UMD-DMSS-83/5) Avail: NTIS HC A02/MF A01 CSCL 12/1

Unbiased estimators of the number of individuals in a lot possessing various patterns of types of defects are constructed. Explicit formulas are given for cases of two and three types of defect. Application of the formulas requires knowledge of the probabilities of various kinds of errors in the inspection process. GRA

N84-15569# Westinghouse Hanford Co., Richland, Wash.
FEASIBILITY OF THERMAL NDE METHODS FOR NAVAL THERMAL SPRAY COATINGS
D. R. Green, C. R. Wandling, M. D. Schmeller (Puget Sound Naval Shipyard, Bremerton, Wash.), and R. A. Sulit (Naval Sea Systems Command, Washington, D.C.) 24 Oct. 1983 29 p refs Presented at the Am. Soc. of Nondestructive Testing Conf., Dallas, 24 Oct. 1983
(Contract DE-AC06-76FF-02170)
(DE84-001463; HEDL-SA-2986; CONF-8310196-1) Avail: NTIS HC A03/MF A01

A feasibility demonstration showed that infrared-thermal scanning can be applied to nondestructively examine the coating-to-substrate bonds in a variety of thermal spray coatings. Emissivity independent and thermal wave methods must be applied in some cases to eliminate the effects of local differences in surface conditions and coating thickness. Rough-surfaced coatings such as those used in anti-skid applications can have thickness varying from about 0.1 inch (3 mm) at peaks to less than 0.04 inch (1 mm) at valleys. Data showing the feasibility of detecting non-bonds even under such rough coatings is described. The present work is the first phase of a program to develop a generally applicable emissivity independent thermal nondestructive examining (NDE) scanning system for thermal spray coatings. High speed, low application cost, high reliability and ease of test interpretation are the prime goals for the final thermal scanning NDE system. The most advanced state-of-the-art methods using thermal wave analysis to make maximum use of the scan information are being incorporated. DOE

N84-15570# Hanford Engineering Development Lab., Richland, Wash.
ULTRASONIC TEST DATA ACQUISITION AND DEFECT VERIFICATION OF STAINLESS STEEL WELDS AT 4000 DEG F
S. J. Mech 1983 15 p refs Presented at the 64th Ann. Am. Welding Soc. Meeting, Philadelphia, 24 Apr. 1983
(Contract DE-AC06-76FF-02170)
(DE83-012146; HEDL-SA-2895-FP; CONF-830485-1) Avail: NTIS HC A02/MF A01

Techniques developed to characterize the features found during ultrasonic examination of stainless steel welds which are indicate defects are described. Feature inspection technology allows reliable discrimination weld signals and other noise under remote, automatic, high temperature conditions. Ultrasonic feature inspection techniques were implemented under 4000F (2000C) flowing sodium pipe welds. Techniques which find defects, but ignore variations associated with the normal cast type microstructure of the weld zone were investigated. Data on a welded pipe section with notches used to simulate defects were studied and computer acquisition and analysis techniques of ultrasonic data are outlined. Analysis methods are compared to find signal analysis algorithms sensitive to these simulated defects. DOE

N84-15571# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
THE USE OF MICROPROCESSORS FOR THE INSTRUMENTATION OF NONDESTRUCTIVE TESTS [L'IMPIEGO DI MICROPROCESSORI IN STRUMENTZIONE PER PROVE NON DISTRUTTIVE]
D. Dotti (Pavia Univ., Italy) and F. Tonolini 1983 13 p refs In ITALIAN Presented at 3rd Congr. Nazl. dell'Assoc. Ital. Prove-non-Distruttive, Venice, 19-21 May 1983
(CISE-2072) Avail: NTIS HC A02/MF A01

The essential characteristics of microprocessor systems are discussed and compared with other data processing systems. Application for nondestructive tests are explored. The design of an ultrasonic inspection system using microprocessors is detailed. The microprocessor gives the coordinates of the ultrasonic sensor and measures the echo intensity at a given depth. The calibration of the system is also discussed. Author (GRA)

N84-15572# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
THE USE OF MATRIX TRANSDUCERS IN MEDIUM THICKNESS WELDING INSPECTION [L'IMPIEGO DEI TRASDUTTORI A MATRICE NELL'ISPEZIONE DI SALDATURE DI MEDIO SPESSORE]
M. Certo, D. Dotti (Pavia Univ., Italy), G. Mariani, A. Parmeggiani, and P. Vidali 1983 14 p refs In ITALIAN Presented at 3rd Congr. Nazl. dell' Assoc. Ital. Prove-non-Distructive, Venice, 19-21 May 1983
(Contract ISEA-2E/000)
(CISE-2075) Avail: NTIS HC A02/MF A01

The use of ultrasonic matrix transducers for the control instrumentation in nondestructive tests of medium and thick welds of metallic structures is discussed. The linear sensor matrix composed of parallel bars of piezoelectric materials permits the deflection and electronic focusing of the ultrasonics both in reception and transmission. The device includes an interface for signal generation and for the amplification of the received echoes, and a minicomputer based on the Z80 microprocessor. Measurements were made generating both longitudinal and transversal waves. The use of transversal waves is found particularly attractive, visualizing the defects in medium thickness welds with good definition, precision and simplicity. Author (ESA)

N84-15308# National Physical Research Lab., Pretoria (South Africa).
A NEW NON-DESTRUCTIVE AND STANDARDLESS METHOD FOR THE THICKNESS DETERMINATION OF THIN FILMS BY XRF MEASUREMENT
W. H. Gries and F. T. Wybenga *In its* Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 83-89 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N84-15573 Case Western Reserve Univ., Cleveland, Ohio.
SOLUTION OF ELASTIC AND ELASTO-PLASTIC PROBLEMS BY THE METHOD OF LINES Ph.D. Thesis
Javed Alam 1983 360 p
Avail: Univ. Microfilms Order No. DA314585

An improved formulation of the method of lines (MOL) is presented. The line method lies between completely analytical methods and completely discrete methods such as finite differences. The five-point finite difference formulas are introduced to reduce a set of coupled partial differential equations into a set of simultaneous ordinary differential equations. The resulting ordinary differential equations are solved by a recurrence relation method, which is found to be very suitable in solving two-point boundary value problems. The formulation is further extended to include the small scale plasticity effect. The Von-Mises criterion is used for yielding and isotropic hardening rule is followed to decide for subsequent yielding. Prantl-Reuss equations are employed as constitutive relations. The resulting nonlinear equations are solved by using the method known as successive elastic solutions. For two specific geometries namely the edge notch specimen and the compact tension specimen, the complete field solutions for stresses and strains are obtained. Dissert. Abstr.

N84-15574# British Library Lending Div., Boston Spa (England).
THEORETICAL AND EXPERIMENTAL DETERMINATION OF STRESS-STRAIN OF HIGH-PRESSURE EQUIPMENT
V. P. Polukhin, N. F. Andrianov, E. V. Popova, and A. V. Novikov 7 Oct. 1983 6 p refs Transl. into ENGLISH from Izv. (USSR), no. 1, 1983 p 64-67
(BLL-M-35287-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

Bending strain arises in a composite chamber consisting of a sleeve shrink-fitted on to a die for synthesizing carbide-forming powders, the stress concentraton factor increases to two in the vicinity of the depression. The nature of the tangential component of the amount of shrink fit (negative clearance) is investigated to study the near contact stress state. Author

N84-15575 Purdue Univ., Lafayette, Ind.
APPLICATION OF INTERACTIVE COMPUTER GRAPHICS IN FINITE ELEMENT ANALYSIS Ph.D. Thesis
Khosrow Nematollaahi 1983 206 p
Avail: Univ. Microfilms Order No. DA8324036

A Unified Data Base System (UDB) for generation of finite element models, analysis of generated models, display of the generated models, and display of deformed shape of the models is presented. The UDB System is divided into three distinct parts as follows: The first part of the system, which is also called the pre-processor, will generate the finite element model and it will also generate the loads and boundary conditions of the model. The second part of the (UDB) system consists of the analysis programs. The GIFTS analysis package may be used for analysis of the generated model based on the finite element analysis technique. The third part is the result display programs. The GIFTS result display program, RESULT, may be used for display of the deformed shapes of the models, graphical presentation of principal stresses, character presentation of failure criterion, and also graphical presentation of stress contours. Dissert. Abstr.

N84-15576 Cornell Univ., Ithaca, N.Y.
AN INTEGRATED SYSTEM FOR SHELLS WITH DISCONTINUITIES: GEOMETRIC MODELLING AND FINITE ELEMENT ANALYSIS Ph.D. Thesis
Samir Lotfy Hanna 1983 196 p
Avail: Univ. Microfilms Order No. DA8321913

The principal results include four developments: (1) a new interactive algorithm for finding the intersection curves of two or more parametric surfaces; (2) new methods of application of finite element meshing techniques; (3) an innovative general-purpose, three-dimensional finite element analysis program; and (4) a unified structural mechanics approach and context for handling shell discontinuities. The method developed for the intersection of parametric surfaces is a numerical 'divide and conquer' procedure with a user-specified accuracy. Computation times are small enough to be suitable for interactive computing. The method can handle combinations of various types of surfaces and blends naturally into the overall procedure for preprocessing of groins. Dissert. Abstr.

N84-15577 Cornell Univ., Ithaca, N.Y.
A PERIODICALLY FORCED PIECEWISE LINEAR OSCILLATOR Ph.D. Thesis
Steven Wayne Shaw 1983 165 p
Avail: Univ. Microfilms Order No. DA8321904

A single degree of freedom nonlinear oscillator with periodic forcing is considered. The nonlinearity is in the restoring force, which is piecewise linear with a single change in slope at displacement X (sub 0). The oscillator serves as a model for more complex mechanical linkages and systems which contain one-sided amplitude constraints. In order to study the motions of this system we employ a method of Poincare' in which the phase space is sliced with a surface of section. The section taken corresponds to motions crossing X (sub 0) with positive velocity, i.e., encounters the amplitude constraint. Solutions of the governing differential equation of motion are studied by considering the Poincare' return map which describes how points in the Poincare' section are mapped back into themselves. We exploit the fact that the equations are locally linear on each side of X (sub 0) and use their explicit solutions in the analysis and in digital simulation performed on a computer. Dissert. Abstr.

N84-15578 Georgia Inst. of Tech., Atlanta.
NONLINEAR ANALYSIS OF THIN SHELLS BY THE HYBRID MIXED FINITE-ELEMENT METHOD Ph.D. Thesis
Chao-Meng Hwang 1983 192 p
Avail: Univ. Microfilms Order No. DA8322557

A simple three node plate bending element is formulated as a hybrid mixed model based on a modified Hu-Washizu variational principle. Two types of triangular shell elements are then developed: the first combines the plate bending element with a CST (Constant Strain Triangle) element. The second combines the plate bending element with an RT (Refined Triangle) element. A modified incremental Hu-Washizu variational principle is derived for large deflection and incremental analysis. The finite element formulation based on this modified multifield variational principle involves the assumption of displacement, strain and stress fields within the element as well as compatible displacement along element boundaries, however, the resulting matrix equations contain only nodal displacements as unknowns. In the incremental analysis the corrective term for stress equilibrium is included in each incremental step. A combined incremental and iterative numerical algorithm is also used for highly nonlinear problems. The constant arc length method of Riks/Wempner is employed to trace the entire deformation path. Dissert. Abstr.

N84-15579 Cincinnati Univ., Ohio.
A COMPREHENSIVE NUMERICAL STUDY AND EXPERIMENTAL VERIFICATION OF ENDOCHRONIC PLASTICITY Ph.D. Thesis
Jinghong Fan 1983 143 p
Avail: Univ. Microfilms Order No. DA832208

Recently considerable attention was paid to the foundation, computational capability, validity and predictive power of the endochronic theory of plasticity. Also a lot of interest was generated on how this revolutionary concept of plasticity without a yield surface is used in the elastoplastic analysis of stress and strain and how the material functions of endochronic plasticity are determined. All of these problems were examined. The basic foundation of the endochronic plasticity theory was reviewed and

compared with that of classical plasticity in terms of the behavior of a simple mechanical model. The comparison shows in this specific instance that classical plasticity is an idealization of the endochronic plasticity. The basic concept, intrinsic time, of endochronic plasticity was borne out by comparing the mathematical description of the above simple mechanical model with that of a dashpot. Dissert. Abstr.

N84-15580 Cornell Univ., Ithaca, N.Y.
FINITE ELEMENT AND BOUNDARY ELEMENT ANALYSIS OF LARGE STRAIN LARGE DISPLACEMENT PROBLEMS IN ELASTOPLASTICITY Ph.D. Thesis
Abhijit Chandra 1983 124 p
Avail: Univ. Microfilms Order No. DA8321862

A finite element and a boundary element formulation are developed for elastoviscoplasticity problems in the presence of large strains and displacements. The formulations are capable of using any of a class of combined creep plasticity state variable models for the description of material behavior. Numerical results are presented for various planar problems using the constitutive model originally proposed by Hart. The analysis can be very useful in understanding various manufacturing processes like extrusion, rolling, sheet metal forming, etc., and an example of plane strain extrusion including thermomechanical coupling is presented to bring out the important effects of variations in several process parameters. The computer programs developed are quite general and can be adapted to study other processes as well.
Dissert. Abstr.

N84-15581 Cincinnati Univ., Ohio.
A THERMODYNAMICALLY CONSISTENT CONSTITUTIVE MODEL FOR INELASTIC FLOW OF MATERIALS Ph.D. Thesis
Nader Mohamed Abuelfoutouh 1983 115 p
Avail: Univ. Microfilms Order No. DA8323181

A set of consistent state variable evolution equations and inelastic flow equations for materials are derived. The macroscopic and microscopic variables are related by the energy balance equation written in terms of Helmholtz free energy. Then, upon interpreting the time rate of the energy stored in the microstructure as a potential function, it follows that the rates of evolution of the state variables are derivable from the rates of inelastic flow. Thus, the flow and evolution equations are associated to satisfy the energy balance during the material flow. These equations should not be picked independently, otherwise there will be a thermodynamic inconsistency in the constitutive model. Using the potential function concept, a consistent state variable model was established by deriving the evolution equation associated with Bodner-Partom inelastic flow equations. This model was applied to predict the response of IN100 at 732 C. Dissert. Abstr.

N84-15582 Ruhr Univ., Bochum (West Germany). Inst. fuer Mechanik.
UNIFIED OPERATOR DESCRIPTION, NONLINEAR BUCKLING AND POST-BUCKLING ANALYSIS OF THIN ELASTIC SHELLS
Helmut Stumpf Dec. 1982 54 p refs Sponsored by Polish Academy of Sciences, Gdansk
(RUB-IFM-MITT-34) Copyright. Avail: Issuing Activity

A nonlinear stability and postbuckling analysis based on energy considerations was performed for nonlinear elastic thin shells with moderate rotations. A unified operator description to formulate the nonlinear shell boundary value problem and to derive in a compact form the equations of critical equilibrium and the equations for a nonlinear postbuckling analysis with singular and multiple buckling modes is presented. All equations are given with associated boundary conditions. The operator description allows relations between the governing equations of the nonlinear shell boundary value problem and the buckling and postbuckling equations to be outlined. Author (ESA)

N84-15583# Central Electricity Generating Board, London (England).
VIBRATION-INDUCED FLUX VARIATION IN THE SPACE BETWEEN TWO CONCENTRIC TUBES
H. Mueller 8 Nov. 1983 18 p refs Transl. into ENGLISH from Z. Angew Math. Mech. (West Germany), v. 62, no. 10, 1982 p 501-509
(BLL-CE-Trans-7949-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Flows in the space between two concentric tubes often occur in engineering. Wherever long thin rods are exposed to an axial flow (usually for cooling purposes) aeroelastic instability may result in transverse vibrations of the rod. An example is fuel rod vibrations in nuclear reactors. They may be self excited or externally generated. They are usually undesirable because they may lead to substantial flux variations and markedly affect the heat exchange. A complete mathematical description of this phenomenon is prevented by its complexity. Apart from the nonlinear character of the Navier-Stokes equations a problem of interaction between flow and vibration is involved, the movement of the inner cylinder not being known a priori, but must be determined at the same time. Hence it is assumed in this paper that the movement of the inner cylinder is firmly impressed on the system from outside in the form of a harmonic vibration, so that only the flow need be determined. The aim is to establish a relationship between the volumetric flow averaged with respect to time and the amplitude and frequency of the vibration. Author

N84-15584# British Library Lending Div., Boston Spa (England).
FRACTURE RESISTANCE OF HARDENED AND TEMPERED PIPES OF 16GFR STEEL
V. A. Marchenko, A. V. Rudchenko, V. I. Krechkovskaya, M. V. Pirusskii, and I. I. Burnyashev 7 Oct. 1983 6 p refs Transl. into ENGLISH from Stal (USSR), no. 1, 1983 p 63-65
(BLL-M-35268-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

The fracture resistance of low carbon, manganese vanadium boron steel 16GFR for high strength quenched and tempered helically welded pipes was evaluated. The steel composition was 0.16% C, 1.3% Mn, 0.3% Si, 0.05% V, 0.003% B. 0.006% S and 0.010% P. Data are reported for impact strength, energy for crack nucleation and propagation and crack arrest temperatures in the Robertson test. Subzero fracture strength is discussed. Pipes of this steel for service in areas with climatic temperatures down to -20 C are recommended. E.A.K.

N84-15585# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FATIGUE CRACK PROPAGATION IN Al-ALLOY LUGS UNDER CONSTANT AMPLITUDE AND MANEUVER SPECTRUM LOADING
A. Buch and A. Berkovits Feb. 1983 50 p refs
(TAE-497) Avail: NTIS HC A03/MF A01

Crack propagation tests on lugs with crack starters made from 2024-T351, 7075-T7361, 2024-T3 and 7475-T761 were carried out under constant amplitude loading and under a maneuver spectrum loading used previously on similar lugs without initial damage. The crack starter was a through thickness artificial crack, 1 mm deep, usually on both sides of each hole. Crack propagation was measured with four crack gages bonded at the critical lug cross-section. The significance of test results is discussed from the viewpoint of the following comparisons: (1) of tests results for different lug materials; (2) of theoretical estimates with test results; (3) of fatigue lives of initial damaged and undamaged lugs; and (4) of the crack growth rate and life under spectrum loading for lugs with crack starters at one and two sides of the hole. M.G.

N84-15586# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
PLANE STRAIN FRACTURE TOUGHNESS OF POLYETHYLENE PIPE MATERIALS
A. Y. Darwish, F. J. Mandell, and F. J. McGarry Dec. 1982 36 p refs
(MIT-RR-R2-2) Avail: NTIS HC A03/MF A01

The plane strain fracture toughness of medium density polyethylene pipe materials was investigated over a range of test temperatures and rates. Conditions are defined under which valid

fracture toughness values can be obtained; at higher temperatures the material is notch-insensitive. Fracture surface morphology is described, and features are compared with predictions from the Dugdale model. The toughness derives from a band of fibrillar, drawn morphology associated with crack initiation or slow growth. The plane strain fracture toughness correlates with percent crystallinity according to the same relationship whether the crystalinity is varied by thermal treatment, comonomer content, or molecular weight. Author

N84-15587*# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering and Applied Mechanics.
HEAT GENERATION IN AIRCRAFT TIRES UNDER BRAKED ROLLING CONDITIONS
Samuel K. Clark and Richard N. Dodge Washington NASA Jan. 1984 55 p refs
(Grant NsG-1607)
(NASA-CR-3768; NAS 1.26:3768) Avail: NTIS HC A04/MF A01 CSCL 20K

An analytical model was developed to approximate the internal temperature distribution in an aircraft tire operating under conditions of unyawed braked rolling. The model employs an array of elements to represent the tire cross section and considers the heat generated within the tire to be caused by the change in strain energy associated with cyclic tire deflection. The additional heating due to tire slip and stresses induced by braking are superimposed on the previously developed free rolling model. An extensive experimental program was conducted to verify temperatures predicted from the analytical model. Data from these tests were compared with calculations over a range of operating conditions. The model results were in reasonably good agreement with measured values. Author

N84-15588*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREFLIGHT TRANSIENT DYNAMIC ANALYSES OF B-52 AIRCRAFT CARRYING SPACE SHUTTLE SOLID ROCKET BOOSTER DROP-TEST VEHICLE Final Report
William L. Ko and Lawrence S. Schuster Jan. 1984 17 p refs Presented at the AIAA 2nd Flight Test Conf., Las Vegas, Nev., 16-18 Nov. 1983 Previously announced as A84-13725
(NASA-TM-84925; H-1197; NAS 1.15:84925) Avail: NTIS HC A02/MF A01 CSCL 20K

This paper concerns the transient dynamic analysis of the B-52 aircraft carrying the Space Shuttle solid rocket booster drop test vehicle (SRB/DTV). The NASA structural analysis (NASTRAN) finite element computer program was used in the analysis. The B-52 operating conditions considered for analysis were (1) landing and (2) braking on aborted takeoff runs. The transient loads for the B-52 pylon front and rear hooks were calculated. The results can be used to establish the safe maneuver envelopes for the B-52 carrying the SRB/DTV in landings and brakings. Author

N84-15589*# Kansas Univ., Lawrence. Structural Engineering and Engineering Materials.
THEORETICAL AND SOFTWARE CONSIDERATIONS FOR NONLINEAR DYNAMIC ANALYSIS Interim Report
Richard J. Schmidt and Robert H. Dodds, Jr. Feb. 1983 299 p refs
(Contract NAG3-32)
(NASA-CR-174504; NAS 1.26:174504; SM-8) Avail: NTIS HC A13/MF A01 CSCL 20K

In the finite element method for structural analysis, it is generally necessary to discretize the structural model into a very large number of elements to accurately evaluate displacements, strains, and stresses. As the complexity of the model increases, the number of degrees of freedom can easily exceed the capacity of present-day software system. Improvements of structural analysis software including more efficient use of existing hardware and improved structural modeling techniques are discussed. One modeling technique that is used successfully in static linear and nonlinear analysis is multilevel substructuring. This research extends the use of multilevel substructure modeling to include dynamic analysis and defines the requirements for a general purpose software system capable of efficient nonlinear dynamic analysis. The multilevel substructuring technique is presented, the analytical formulations and computational procedures for dynamic analysis and nonlinear mechanics are reviewed, and an approach to the design and implementation of a general purpose structural software system is presented. E.A.K.

N84-15590*# Computer Software Management and Information Center, Athens, Ga.
ELEVENTH NASTRAN USER'S COLLOQUIUM
Washington Nov. 1983 310 p refs Colloq. held in San Francisco, 2-6 May 1983 Sponsored by NASA, Washington
(NASA-CP-2284; NAS 1.55:2284) Avail: NTIS HC A14/MF A01 CSCL 20K

NASTRAN (NASA STRUCTURAL ANALYSIS) is a large, comprehensive, nonproprietary, general purpose finite element computer code for structural analysis which was developed under NASA sponsorship. The Eleventh Colloquium provides some comprehensive general papers on the application of finite element methods in engineering, comparisons with other approaches, unique applications, pre- and post-processing or auxiliary programs, and new methods of analysis with NASTRAN. For individual titles, see N84-15591 through N84-15608.

N84-15591*# Sperry Gyroscope Co., Great Neck, N. Y.
BANDIT IN NASTRAN
Gordon C. Chan *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 1-5 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

BANDIT has been implemented into the NASTRAN April '83 release. It is now a permanent feature in NASTRAN and will be included in all future releases for all four computing machines (IBM, CDC, UNIVAC, and VAX). Originally BANDIT operated as a preprocessor of NASTRAN. It read the NASTRAN input cards and produced a set of resequencing (SEOGP) cards that would greatly reduce the computational time required by the matrix decomposition module of NASTRAN for a large structure. In the past, many computer centers had installed BANDIT in their systems together with the NASTRAN program. The user would run the BANDIT program and NASTRAN as if they were one program (or two separated programs depending on how the two programs were actually tied together in the computer systems). In some cases, the user was required to pass the input cards and the output SEQGP cards between the two programs, and n others, the data was manipulated through the use of cataloged disc files. Although there is nothing wrong with this BANDIT-NASTRAN arrangement, there are, however, several shortcomings which are mentioned in this paper. The BANDIT in the NASTRAN April '83 release has removed all the deficiencies, and it comes in one version applicable to the four computing machines. B.W.

N84-15592*# McDonnell-Douglas Corp., St. Louis, Mo.
NASA/MSFC NASTRAN AUXILIARY I/O ROUTINES
Malcolm Tagg and Bob Thornton (Boeing Co., Seattle, Wash.) *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 6-20 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

Since the initial installation of NASTRAN on the UNIVAC 1100/82 computer at the Marshall Space Flight Center (MSFC), a number of local codes have been incorporated as user routines. This paper describes four of these codes and how interested users may obtain additional information. Author

N84-15593*# Oak Ridge National Lab., Tenn. Fusion Energy Div.
USING PAFEC AS A PREPROCESSOR FOR COSMIC/NASTRAN
W. H. Gray and T. V. Baudry (PAFEC Engineering Consultants) *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 21-32 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

Programs for Automatic Finite Element Calculations (PAFEC) is a general purpose, three dimensional linear and nonlinear finite element program (ref. 1). PAFEC's features include free format input utilizing engineering keywords, powerful mesh generating facilities, sophisticated data base management procedures, and extensive data validation checks. Presented here is a description of a software interface that permits PAFEC to be used as a preprocessor for COSMIC/NASTRAN. This user friendly software, called PAFCOS, frees the stress analyst from the laborious and error prone procedure of creating and debugging a rigid format COSMIC/NASTRAN bulk data deck. By interactively creating and debugging a finite element model with PAFEC, thus taking full advantage of the free format engineering keyword oriented data structure of PAFEC, the amount of time spent during model generation can be drastically reduced. The PAFCOS software will automatically convert a PAFEC data structure into a COSMIC/NASTRAN bulk data deck. The capabilities and limitations of the PAFCOS software are fully discussed in the following report.
Author

N84-15594*# Naval Ship Research and Development Center, Bethesda, Md.
THE GPRIME APPROACH TO FINITE ELEMENT MODELING
Dolores R. Wallace, James H. McKee, and Myles M. Hurwitz *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 33-45 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

GPRIME, an interactive modeling system, runs on the CDC 6000 computers and the DEC VAX 11/780 minicomputer. This system includes three components: (1) GPRIME, a user friendly geometric language and a processor to translate that language into geometric entities, (2) GGEN, an interactive data generator for 2-D models; and (3) SOLIDGEN, a 3-D solid modeling program. Each component has a computer user interface of an extensive command set. All of these programs make use of a comprehensive B-spline mathematics subroutine library, which can be used for a wide variety of interpolation problems and other geometric calculations. Many other user aids, such as automatic saving of the geometric and finite element data bases and hidden line removal, are available. This interactive finite element modeling capability can produce a complete finite element model, producing an output file of grid and element data. Author

N84-15595*# Lockheed-Georgia Co., Marietta.
ORTHOTROPIC HOLE ELEMENT
J. W. Markham and C. V. Smith (Georgia Inst. of Technology) *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 46-75 (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

A finite element was developed to adequately represent the state of stress in the region around a circular hole in orthotropic material experiencing reasonably general loading. This has been achieved through a complementary virtual work formulation of the stiffness and stress matrices for a square element with a center circular hole. The element has been incorporated into COSMIC/NASTRAN as a dummy element. Sample problems have been solved and these results are presented. Author

N84-15596*# Naval Ship Research and Development Center, Bethesda, Md.
GENERALIZING THE TRAPRG AND TRAPAX FINITE ELEMENTS
Myles M. Hurwitz *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 76-81 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

The NASTRAN TRAPRG and TRAPAX finite elements are very restrictive as to shape and grid point numbering. The elements must be trapezoidal with two sides parallel to the radial axis. In addition, the ordering of the grid points on the element connection card must follow strict rules. The paper describes the generalization of these elements so that these restrictions no longer apply.
Author

N84-15597*# Bell Aerospace Co., Buffalo, N. Y.
ACOUSTICAL MODES OF ARBITRARY VOLUMES USING NASTRAN TRANSIENT HEAT TRANSFER RF9
V. Elchuri, G. C. C. Smith, and A. Michael Gallo *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 82-88 (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

An equivalence between temperature and pressure, heat conduction and stiffness and heat capacity and mass is defined, enabling acoustical modal analysis of arbitrary three dimensional volumes. The transient heat transfer analysis rigid format in NASTRAN, RF9, has been altered providing the acoustical analysis capability. Examples and ALTERs are included. Author

N84-15598*# Bell Aerospace Co., Buffalo, N. Y.
AN ALTERNATIVE METHOD OF ANALYSIS FOR BASE ACCELERATED DYNAMIC RESPONSE IN NASTRAN
V. Elchuri, A. Michael Gallo, and G. C. C. Smith *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 89-112 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

An alternative method of analysis to determine the dynamic response of structures subjected to bese accelerations is presented. The method is exact as opposed to the approximate technique of using unusually large masses and loads to enforce desired base accelerations. This paper presents the relevant equations to motion, ALTERs for direct and modal frequency-, random- and transient-response rigid formats, and illustrative examples. Author

N84-15599*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NASTRAN DMAP PROCEDURE FOR CALCULATION OF BASE EXCITATION MODAL PARTICIPATION FACTORS
William R. Case *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 113-140 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

This paper presents a technique for calculating the modal participation factors for base excitation problems using a DMAP alter to the NASTRAN real eigenvalue analysis Rigid Format. The DMAP program automates the generation of the seismic mass to add to the degrees of freedom representing the shaker input directions and calculates the modal participation factors. These are shown in the paper to be a good measure of the maximum acceleration expected at any point on the structure when the subsequent frequency response analysis is run. B.W.

N84-15600*# Naval Ship Research and Development Center, Bethesda, Md.
FINITE ELEMENT ANALYSIS OF FLUID-FILLED ELASTIC PIPING SYSTEMS
G. C. Everstine, M. S. Marcus, and A. J. Quezon *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 141-160 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

Two finite element procedures are described for predicting the dynamic response of general 3-D fluid-filled elastic piping systems. The first approach, a low frequency procedure, models each straight pipe or elbow as a sequence of beams. The contained fluid is modeled as a separate coincident sequence axial members (rods) which are tied to the pipe in the lateral direction. The model includes the pipe hoop strain correction to the fluid sound speed and the flexibility factor correction to the elbow flexibility. The second modeling approach, an intermediate frequency procedure, follows generally the original Zienkiewicz-Newton scheme for coupled fluid-structure problems except that the velocity potential is used as the fundamental fluid unknown to symmetrize the coefficient matrices. From comparisons of the beam model predictions to both experimental data and the 3-D model, the beam model is validated for frequencies up to about two-thirds of the lowest fluid-filled labor pipe mode. Accurate elbow flexibility

factors are seen to be crucial for effective beam modeling of piping systems. Author

N84-15601*# Naval Underwater Systems Center, New London, Conn.
PROPAGATING PLANE HARMONIC WAVES THROUGH FINITE LENGTH PLATES OF VARIABLE THICKNESS USING FINITE ELEMENT TECHNIQUES
J. H. Clark, A. J. Kalinowski, and C. A. Wagner *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 161-177 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

An analysis is given using finite element techniques which addresses the propagaton of a uniform incident pressure wave through a finite diameter axisymmetric tapered plate immersed in a fluid. The approach utilized in developing a finite element solution to this problem is based upon a technique for axisymmetric fluid structure interaction problems. The problem addressed is that of a 10 inch diameter axisymmetric fixed plate totally immersed in a fluid. The plate increases in thickness from approximately 0.01 inches thick at the center to 0.421 inches thick at a radius of 5 inches. Against each face of the tapered plate a cylindrical fluid volume was represented extending five wavelengths off the plate in the axial direction. The outer boundary of the fluid and plate regions were represented as a rigid encasement cylinder as was nearly the case in the physical problem. The primary objective of the analysis is to determine the form of the transmitted pressure distribution on the downstream side of the plate. R.J.F.

N84-15602*# Naval Underwater Systems Center, New London, Conn.
PROPAGATION OF FLEXURAL AND MEMBRANE WAVES WITH FLUID LOADED NASTRAN PLATE AND SHELL ELEMENTS
A. J. Kalinowski and C. A. Wagner *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 178-206 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

Modeling of flexural and membrane type waves existing in various submerged (or in vacuo) plate and/or shell finite element models that are excited with steady state type harmonic loadings proportioned to e(i omega t) is discussed. Only thin walled plates and shells are treated wherein rotary inertia and shear correction factors are not included. More specifically, the issue of determining the shell or plate mesh size needed to represent the spatial distribution of the plate or shell response is of prime importance towards successfully representing the solution to the problem at hand. To this end, a procedure is presented for establishing guide lines for determining the mesh size based on a simple test model that can be used for a variety of plate and shell configurations such as, cylindrical shells with water loading, cylindrical shells in vacuo, plates with water loading, and plates in vacuo. The procedure for doing these four cases is given, with specific numerical examples present only for the cylindrical shell case. R.J.F.

N84-15603*# Sverdrup Technology, Inc., Arnold Air Force Station, Tenn.
DYNAMIC CERTIFICATION OF A THRUST-MEASURING SYSTEM FOR LARGE SOLID ROCKET MOTORS
R. A. LeMaster and R. B. Runyan *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 207-225 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

The J-4 Rocket Test Cell and its Thrust Measuring System (TMS) at Arnold Engineering Development Center were modified to provide multicomponent force measurement of large solid rocket motors having nozzle gimbaling capability. To verify the structural integrity of a combined TMS and motor system, a large finite element model of the TMS and motor was developed using the NASTRAN computer program. Due to the importance of obtaining accurate estimates for the dynamic force levels, it was necessary to certify that the model adequately simulated the physical system. This was accomplished by performing a modal analysis test on the TMS and motor combination. The objectives were to discuss the physical characteristics of the TMS and motor that influence the NASTRAN model; to compare the frequency response characteristics computed using the NASTRAN model to those obtained from the modal analysis test; to discuss the experiences gained in modal analysis testing; and to demonstrate how state-of-the-art experimental and analytical methods are used in the design of ground test facilities. R.J.F.

N84-15604*# Gates Learjet Corp., Denver, Colo.
DETERMINATION OF ELEVATOR AND RUDDER HINGE FORCES ON THE LEARJET MODEL 55 AIRCRAFT
Robert R. Boroughs and Viswa Padmanabhan *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 226-248 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

The empennage structure on the Learjet 55 aircraft was quite similar to the empennage structure on earlier Learjet models. However, due to an important structural change in the vertical fin along with the new loads environment on the 50 series aircraft, a structural test was required on the vertical fin, but the horizontal tail was substantiated by a comparative analysis with previous tests. NASTRAN analysis was used to investigate empennage deflections, stress levels, and control surface hinge forces. The hinge force calculations were made with the control surfaces in the deflected as well as undeflected configurations. A skin panel buckling analysis was also performed, and the non-linear effects of buckling were simulated in the NASTRAN model to more accurately define internal loads and stress levels. Comparisons were then made between the Model 55 and the Model 35/36 stresses and internal forces to determine which components were qualified by previous tests. Some of the methods and techniques used in this analysis are described. R.J.F.

N84-15605*# RPK Corp., Athens, Ga.
A NEW METHOD FOR GENERATING AND MAINTAINING RIGID FORMATS IN NASTRAN
P. R. Pamidi and W. Keith Brown *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 249-254 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

A new method for generating and updating Rigid Formats in NASTRAN is discussed. The heart of this method is a Rigid Format data base that is in card-image format and that can therefore be easily maintained by the use of standard text editors. Each Rigid Format entry in this data base will contain the Direct Matrix Abstraction Program (DMAP) for that Rigid Format along with the related restart, subset and substructure control tables. NASTRAN will read this data base directly in every NASTRAN run and perform the necessary transformations to allow the DMAP to be processed and compiled by the NASTRAN executive. This approach will permit Rigid Formats to be changed without unnecessary compilations and relinking of NASTRAN. Furthermore, this approach will also make it very easy for users to make permanent changes to existing Rigid Formats as well as to generate their own Rigid Formats. This new method will be incorporated in a future release of the public version of NASTRAN. R.J.F.

N84-15606*# Grumman Aerospace Corp., Bethpage, N.Y.
IMPLEMENTATION OF ELASTIC-PLASTIC STRUCTURAL ANALYSIS INTO NASTRAN
Alvin Levy, A. B. Pifko, and P. L. Ogilvie *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 255-280 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

Elastic-plastic analytic capabilities were incorporated into the NASTRAN program. The present implementation includes a general rigid format and additional bulk data cards as well as to two new modules. The modules are specialized to include only perfect plasticity of the CTRMEN and CROD elements but can easily be expanded to include other plasticity theories and elements. The practical problem of an elastic-plastic analysis of a ship's bracket connection is demonstrated and compared to an equivalent analysis

using Grumman's PLANS program. The present work demonstrates the feasibility of incorporating general elastic-plastic capabilities into NASTRAN. R.J.F.

N84-15607*# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
ELASTIC-PLASTIC ANALYSIS OF ANNULAR PLATE PROBLEMS USING NASTRAN
P. C. T. Chen *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 281-292 refs (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

The plate elements of the NASTRAN code are used to analyze two annular plate problems loaded beyond the elastic limit. The first problem is an elastic-plastic annular plate loaded externally by two concentrated forces. The second problem is stressed radially by uniform internal pressure for which an exact analytical solution is available. A comparison of the two approaches together with an assessment of the NASTRAN code is given. R.J.F.

N84-15608*# Computer Software Management and Information Center, Athens, Ga.
BOLT IN BORE BOUNDARIES
T. G. Butler (Butler Analyses) *In* COSMIC 11th NASTRAN User's Colloq. Nov. 1983 p 293-303 (For primary document see N84-15590 06-39)
Avail: NTIS HC A14/MF A01 CSCL 20K

The factors that must be taken into consideration when applying NASTRAN's linear analysis to structures whose principle boundaries are formed by bolting, and for which localized stress peaking is important are discussed. An illustration is given in an application to a mounting bracket. R.J.F.

N84-15609# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
STRESS MEASUREMENTS IN ICE
Gordon F. N. Cox and Jerome B. Johnson Aug. 1983 39 p
(DA Proj. 4A1-61101-A-91-D)
(AD-A133906; CRREL-83-23) Avail: NTIS HC A03/MF A01 CSCL 08/12

The problems associated with measuring stresses in ice are reviewed. Theory and laboratory test results are then presented for a stiff cylindrical sensor made of steel that is designed to measure ice stresses in a biaxial stress field. Loading tests on freshwater and saline ice blocks containing the biaxial ice stress sensor indicate that the sensor has a resolution of 20 kPa and an accuracy of better than 15% under a variety of uniaxial and biaxial loading conditions. Principal stress directions can also be determined within 5 degrees. The biaxial ice stress sensor is not significantly affected by variations in the ice elastic modulus, ice creep or differential thermal expansion between the ice and gauge. The sensor also has a low temperature sensitivity (5 kPa/deg C). GRA

N84-15610# North Carolina Agricultural and Technical State Univ., Greensboro. School of Engineering.
REFINED TEST METHODS IN EVALUATING BRITTLE MATERIAL STRENGTHS Final Report
William J. Craft and George J. Filatovs 2 Dec. 1982 72 p
(Contract N00019-79-C-0574)
(AD-A133596; Rept-340-20209) Avail: NTIS HC A04/MF A01 CSCL 11/2

This report is a follow-up of the work done under the previous contract, entitled, Fracture Prediction in Brittle Materials. In the former contract, an analytical system was devised to generate fracture data based on: (1) conversion of triaxial fracture data to a single variable, phi, the angle on the fracture surface from point of fracture to the n=(1,1,1) direction, (2) the creation of a simple test procedure and specimen design to find a variety of points on the fracture surface, and (3) the design of experiments to employ this testing system. In the first contract, both alumina and mullite specimens were tested in four-point loading and these results were reduced to a Weibull distribution by determination of the two-parameter coefficients. In this contract, a torsion test method and apparatus were designed and implemented. Both alumina and mullite specimens, the same geometry as was used in the four-point bend test of the previous contract were loaded in torsion to failure at another angle on the fracture surface, or at phi = 90 degs to the n=(1,1,1) direction. The results are given for alumina and mullite tests. Finally, a general test utilizing thick disks of each material is described. GRA

N84-15611# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT. USER'S GUIDE: COMPUTER GRAPHICS PROGRAM FOR GENERATION OF ENGINEERING GEOMETRY (SKETCH) Final Report
John A. Brewer, III Jun. 1983 42 p
(AD-A133600; WES-IR-K-83-2) Avail: NTIS HC A03/MF A01 CSCL 09/2

SKETCH is a FORTRAN program which is intended to provide quick and painless generation of engineering geometry. The program will utilize any of a number of Tektronix storage tube terminals, including the 4010 and the 4014. Input devices include the terminal keyboard, cross hair thumbwheels, Tek 4953 and 4963 digitizing tablets, and an experimental mouse developed at LSU. The objective of the program is to automatically convert two-dimensional picture data into a rich data base consisting of three-dimensional coordinates, lines, polygonal faces, curves, and surfaces. The version of SKETCH (Version 3, Modification 1) that this document reflects does not, as yet, support surface patches (faces with curved boundaries). In order to create complex geometry involving curve segments (and in the future surface patch data), a polyhedra description is roughly sketched, dimensioned, and automatically converted to three-dimensional data. The lines of the precisely dimensioned polyhedra and polygonal cross sections serve as control data and boundary conditions to define arcs, circles, and quadratic or cubic curve forms. Author (GRA)

N84-15612# Berkeley Scientific Translation Service, Calif.
BENDING ELASTICITY OF CIRCULARLY NOTCHED BARS AS MONOLITHIC FLEXURE HINGES IN PRECISION MECHANISMS
Mitsuru Tanaka and Kan Nakayama 5 Nov. 1983 33 p refs Transl. into ENGLISH of technical report from the National Research Lab. of Metrology, Japan
(Contract W-7405-eng-48)
(DE84-002199; UCRL-Trans-11918) Avail: NTIS HC A03/MF A01

The elastic properties of a circular notched bar under bending load are treated by the theory of thin plates, by the theory based on the rigorous solution of a hyperbolic notch and by the structural analysis of the finite element method respectively. The experimental results on the bending elastic coefficients verify these theoretical treatments not only in the thickness dependences on the geometrical parameters, but also in the absolute values with a difference of less than 20%. As far as the theoretical treatments are concerned, the geometrical average of the thickness of the notched bar and the radius of the circle are universally found to be the significant parameters in estimating the elastic properties. And also in the numerical analysis procedure, a systematic method to generae the elements in the circular notched bar is proposed, which will be a useful tool in further numerical analysis with the highest precision. DOE

N84-15613# Sandia Labs., Albuquerque, N. Mex.
GENERAL METHOD FOR FATIGUE ANALYSIS OF VERTICAL AXIS WIND TURBINE BLADES
Paul S. Veers Oct. 1983 20 p
(Contract DE-AC04-76DP-00789)
(DE84-002654; SAND-82-2543) Avail: NTIS HC A02/MF A01

The fatigue life of wind turbine blades that are exposed to the random loading environment of atmospheric winds is described. The incident wind speed and the stresses caused by these winds were expressed in probability density functions, and the fatigue

life vs stress level relationship was determined. A damage density function to express fatigue damage as a function of wind speed is used. The area under the damage density function is inversely related to total fatigue life. An increase in fatigue life caused by restricted operation in certain wind regimes is visualized. An on-parameter is introduced. DOE

N84-15614# Argonne National Lab., Ill. Components Technology Div.
TUBE VIBRATION IN INDUSTRIAL-SIZE TEST HEAT EXCHANGER (90 DEG SQUARE LAYOUT)
H. Halle and M. W. Wambsganss Feb. 1983 81 p refs
(Contract W-31-109-eng-38)
(DE83-011931; ANL-83-10) Avail: NTIS HC A05/MF A01

Tube vibrations in heat exchangers were investigated with an industrial size test exchanger. Results from water flow tests of eleven different tube bundles, in six and eight crosspass configurations on a 900 square layout with a pitch to diameter ratio of 1.25 are reported. The test cases include full tube bundles, no tubes in window bundles, finned tube bundles, and proposed field and design fixes. The testing focused on identification of the lowest critical flowrate to initiate fluidelastic instability and the location within the bundle of the tubes which first experience instability. Instability criteria and pressure drop data are evaluated. DOE

N84-15615# Hanford Engineering Development Lab., Richland, Wash.
MINIATURE CENTER-CRACKED-TENSION SPECIMEN FOR FATIGUE CRACK GROWTH TESTING
A. M. Ermi and L. A. James Sep. 1983 23 p Presented at the Symp. on the Use of Nonstandard Subsized Specimens for Irradiated Testing, Albuquerque, N. Mex., 23 Sep. 1983
(Contract DE-AC06-76FF-02170)
(DE84-001470; HEDL-SA-2913; CONF-8309170-3) Avail: NTIS HC A02/MF A01

A miniature specimen to characterize the effects of neutron irradiation on the fatigue crack growth behavior of candidate fusion reactor first wall materials was developed. The specimen was designed using the following guidelines: (1) it must be small enough to be compatible with existing irradiation facilities; (2) it must be capable of being economically tested in the relative large numbers required in an alloy development program; and (3) it must be large enough to produce valid results. Questions regarding thickness, buckling, excessive plasticity, accuracy of crack length measurements, length to width ratio and proximity of welds to the notch are addressed. DOE

N84-15616# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
WE NEED SIMPLICITY AND SPEED. SOME EXAMPLES OF SIMPLE AND FAST METHODS FOR THE MEASUREMENT OF DEFORMATIONS OF STRUCTURES
P. J. Sevenhuijsen Mar. 1982 15 p refs Presented at British Soc. for Strain Meas./RAE Joint Conf. 1982 State of the Art in Meas. Tech., Surrey, Engl., 6-9 Sep. 1982
(NLR-MP-82021-U) Avail: NTIS HC A02/MF A01

Measuring methods for experimental mechanics are presented. The methods are: stress gages instead of strain gages; square ring force transducers instead of round ring force transducers; dual constant current circuit scanner with three reference resistors; separation of principal strains in photoelastic coatings by a prism and a reflection polariscope; and an elementary grid method for the measurement of in-plane deformations using photoelectronic cameras and telecentric lenses. Author (ESA)

N84-15617# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
MATERIAL SELECTION AND STRUCTURAL DESIGN FOR SAFETY AND DURABILITY
R. J. H. Wanhill May 1982 16 p refs Presented at Intern. Conf. on Fracture Mech. Technol. applied to Mater. Evaluation and Struct. Design, Melbourne, 10-13 Aug. 1982
(NLR-MP-82023-U) Avail: NTIS HC A02/MF A01

Selection of structural materials with respect to fracture mechanics is discussed. Safe life, fail safe, and damage tolerance structural design philosophies are outlined. Planning for fracture control in order to ensure operational safety and durability is considered. Author (ESA)

N84-15618# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
BRIEF NOTE OF THE STRESS INTENSITY FACTOR OF ELLIPTICAL CRACKS
J. Schijve Mar. 1983 9 p refs
(PB83-216911; MEMO/M-460) Avail: NTIS HC A02/MF A01
CSCL 20K

The stress intensity factor solution is presented for an elliptical crack in an infinite body loaded by stress S perpendicular to the plane of the crack. Author

N84-15619 Clemson Univ., S.C.
THE DYNAMIC RESPONSE CHARACTERISTICS OF A VISCOELASTIC BEAM ON PERIODICALLY-SPACED, VISCOELASTIC SUPPORTS Ph.D. Thesis
Francis Rufus Bourne 1983 143 p
Avail: Univ. Microfilms Order No. DA8320261

Many physical systems are modeled as a continuous beam on periodically-spaced, flexible supports. In order to properly design such a system, an understanding of its characteristic dynamic behavior is helpful. The dynamic response characteristics of a continuous beam on discrete, periodically-spaced, flexible supports as a function of several system parameters are established. Free vibration analyses are performed to establish natural frequency trends as functions of system size, relative support stiffness to beam stiffness and end conditions. Straight beams and beams with single 90 degree bends are studied. Beam elements are modeled using simple beam theory. Continuity conditions at each support are applied and a characteristic matrix is constructed. The eigenanalysis is performed using singular value analysis and normal modes are stored for use in the forced vibration analysis. Dissert. Abstr.

N84-15620 Southern Methodist Univ., Dallas, Tex.
SITE-DEPENDENT INELASTIC RESPONSE SPECTRA Ph.D. Thesis
Fawsi E. Elghadamsi 1983 323 p
Avail: Univ. Microfilms Order No. DA8316464

A statistical analysis was used on two ensembles of earthquake accelerograms to establish a site-dependent inelastic design spectrum. The ensembles include fifty records on alluvium and twenty six on rock. The currently available procedure for the computation of an inelastic yield spectrum, which uses the ductility as a parameter to present the spectrum was found not to be feasible for a large number of records because of the extensive computations required in the statistical analysis. Consequently, a new approach which uses the yield level as a major parameter in presenting the inelastic spectrum was developed and used in the study. It is believed that the proposed procedure requires approximately 5 to 10 percent of the computational time needed for the inelastic yield spectrum approach. In order to study the effect of structural nonlinearity on the inelastic response, four models are considered in the study. They include the elastic-plastic, bilinear, four-parameter Nadai, and a newly developed stiffness-degrading that accounts for the translational and rotational characteristics observed in the hysteresis loops of deteriorating structures. Dissert. Abstr.

N84-15621 Illinois Univ., Chicago.
A THREE-DIMENSIONAL PHOTOELASTIC INVESTIGATION OF STRESSES AND CRACKS FORMED IN CONCRETE AROUND DEFORMED REINFORCING BARS Ph.D. Thesis
Farhad Ansari 1983 149 p
Avail: Univ. Microfilms Order No. DA8320618

When deformed bars are used as tensile reinforcement, the characteristics of the cracks formed in the concrete around the reinforcement are basically different from those of cracks formed

around plain bars. These cracking characteristics of deformed bars influence or even define the bond mechanism between deformed bars and concrete. For rational design of structures subjected to unusual loading such as earthquakes, it is desirable to know the state of stress in concrete around the reinforcing ribs and, also, to predict the intensity and pattern of cracks formed. Stress freezing technique of photoelasticity was employed to evaluate the three-dimensional principal state of stress in concrete around a deformity in tensile and pull-out tests. Stress trajectories produced from the results of experiments completely predict the crack pattern in concrete and agree with test results on concrete. Stress intensity factors due to transverse and splitting cracks were calculated combining linear elastic fracture mechanics and three-dimensional photoelasticity. A new shape of reinforcing rib is introduced and examined along with the conventional shape in order to compare and study the difference in stress states and crack patterns.
Dissert. Abstr.

N84-15622 Pennsylvania State Univ., University Park.
ANALYSIS OF PLATES BY THE INITIAL-VALUE METHOD Ph.D. Thesis
Husain Ali Al-Khaiat 1983 230 p
Avail: Univ. Microfilms Order No. DA8320858

The initial-value method, which is an approximate numerical method, is applied for the analysis of plate structures. The results and efficiency of the method are compared to the results of classicial, finite-difference, and finite-element methods. A wide variety of plate problems is considered, which include plates with in-plane loading, orthotropic plates, and free vibration of plates. The initial-value method is applied to the analysis of plates on an elastic foundation. Various loading and boundary conditions are considered. A few problems of continuous plates on an elastic foundation are discussed. For each case, tables are developed to aid the analyst in determining the maximum values of deflections and moments. The results are given in a nondimensional form. The method is also applied to the analysis of rectangular plates with rectangular openings. Simply supported edges and fixed edges are the only boundary conditions that are considered. Most of the problems that are discussed are square plates with square openings of different sizes. For each case, nondimensional results are given for the values of the deflections and the moments at various points of the plate. Dissert. Abstr.

N84-15623 Stanford Univ., Calif.
AEROELASTIC ANALYSIS OF A DARRIEUS TYPE WIND TURBINE BLADE WITH TROPOSKIEN GEOMETRY Ph.D. Thesis
Fred Nitzsche 1983 163 p
Avail: Univ. Microfilms Order No. DA8320754

An approach is proposed to study the general problem of free vibration of one-dimensional structures and in particular one of a blade initially curved in the troposkein shape. The present scheme links for the first time two already existing ideas: the transfer matrices which were first developed in the 50's and the relatively recent idea of integrating matrices. Modal superposition is employed to study the flutter problem when the blade is aerodynamically loaded according to two hypothetical experiments. In the first, a vacuum chamber containing the rotating troposkein blade is brought up to the sea level air density. The second experiment consists of placing the rotating blade in the wind tunnel, increasing the velocity of the wind from zero to characteric values in the operating range of the turbine. The root-locus method of tracing complex roots of the flutter determinant in the frequency-domain is used in the first experiment, whereas the Floquet-Liapunov stability theory is applied to the second. The stability of the blade as a function of different support conditions, elastic axis location, turbine speed and structural daming is studied in detail. Dissert. Abstr.

N84-15624 New Hampshire Univ., Durham.
MULTIPLE SCATTERING FROM A RANDOM AND INHOMOGENEOUS SLAB Ph.D. Thesis
Haci-Murat Hubey 1983 79 p
Avail: Univ. Microfilms Order No. DA8320649

The reflection and transmission functions of an inhomogeneous slab are calculated by labeling the wave by the number of reflections it has undergone in the medium. The Riccati equation, satisfied by the reflected amplitude, is decomposed into a finite set of linear equations by taking into account the number of scatterings taking place inside the medium and is solved by a novel iterative approach. The order-of-scattering reflection functions method preented here and the coupled integral equation approach of the Bremmer solutions for the internal fluxes are set in a unified frame. The solutions of the Riccati equation are computed numerically for the reflection function using the order-of-scattering technique, and it is demonstrated that the method leads to better convergence and stability as compared to usual linearization methods. The Order-of-Scattering Solutions (BVU Series) of the Riccati Equation for the reflection function of an inhomogeneous slab are used to calculate the mean power intensity for a medium having random fluctuations of its dielectric constant. A solution for a Fokker-Planck-like differential equation for the joint probability density of the real and imaginary parts of the reflection function is obtained using a technique due to Van Kampen for nonlinear equations with multiplicative noise. Dissert. Abstr.

N84-15625 Wisconsin Univ., Madison.
INVESTIGATION OF STATIC AND DYNAMIC FRACTURE OF ORTHOTROPIC MEDIA BY PHOTOMECHANICS Ph.D. Thesis
Elizabeth Ann Fuchs 1983 185 p
Avail: Univ. Microfilms Order No. DA8317024

Recognizing that quantitative assessment of the influence of a flaw or defect is essential for design, stress intensity factors around crack tips in orthotropic materials are determined. Optical methods of moire, holography and Young's fringes were used to measure displacements and strains, from which the stress intensity factors were obtained. Experimental data were gathered from both glass-composite and wood specimens. Static and propagating cracks were investigated at room and cryogenic temperatures. Experimental results are correlated with those from finite-elements. Dissert. Abstr.

N84-16054*# Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.
STIFFNESS PROPERTIES FOR DYNAMIC MODELING OF COMPOSITE GRAPHITE-EPOXY CYLINDRICAL ORTHOTROPIC SHELLS
R. Noel Tolbert *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 34 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20K

N84-16056*# Alabama Univ., Huntsville. Dept. of Aerospace Engineering.
FINITE ELEMENT ANALYSIS OF A DEPLOYABLE SPACE STRUCTURE
George E. Weeks *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 24 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N84-15626*# State Univ. of New York, Albany.
[THEMATIC MAPPER RADIOMTRIC VARIABILITY ON OSTENSI-

BLY UNIFORM AGRICULTURAL SCENES] Quarterly Status and Technical Progress Report
M. J. Duggin 7 Nov. 1983 7 p refs ERTS
(Contract NAS5-27595)
(E84-10035; NASA-CR-174587; NAS 1.26:174587) Avail: NTIS HC A02/MF A01 CSCL 05B

The effects of the interaction of the sensor point spread function with a heterogeneous scene consisting of elements giving rise to different spectral radiant intensities cause errors in multitemporal signatures due to fractional pixel repositioning errors. In the case of a heterogeneous scene, the repositioning accuracy between acquisitions could affect the radiometric output in any band and could affect the spectral distribution of radiance between bands. Error caused by within-band and between-band variations in radiance with time could be compounded by resampling along and between scan lines during processing. The magnitude of both error sources depends on the degree of heterogeneity of the scene. A.R.H.

N84-15627*# Wisconsin Univ., Madison. Geophysical and Polar Research Center.
INVESTIGATION OF ANTARCTIC CRUST AND UPPER MANTLE USING MAGSAT AND OTHER GEOPHYSICAL DATA M.S. Thesis. Final Report, Sep. 1979 - Aug. 1983
Charles R. Bentley and Michael H. Ritzwoller 1 Sep. 1983 141 p refs ERTS
(Contract NAS5-25977)
(E84-10055; NASA-CR-173136; NAS 1.26:173136) Avail: NTIS HC A07/MF A01 CSCL 08G

Data selection and reduction procedures are described by which scalar and vector magnetic anomaly maps are constructed. The scalar and vertical magnetic anomalies are believed to be generated mainly in the Earth's crust. The horizontal anomalies are believed to be mainly due to short-period field-aligned currents. The correlation of scalar magnetic anomalies with known oceanic structure is remarkable -- magnetic highs are associated with oceanic ridges and magnetic lows with abyssal plains. The correlation between anomalies and continental geology is not so clear. Author

N84-15628*# Pennsylvania State Univ., University Park. Dept. of Geosciences.
COMBINED USE OF REMOTE SENSING AND SEISMIC OBSERVATIONS TO INFER GEOLOGICALLY RECENT CRUSTAL DEFORMATION, ACTIVE FAULTING, AND STRESS FIELDS Final Technical Report, 1 May 1980 - 30 Nov. 1982
Shelton S. Alexander, Principal Investigator 30 Nov. 1982 248 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Grant NAG5-49)
(E84-10057; NASA-CR-173138; NAS 1.26:173138) Avail: NTIS HC A11/MF A01 CSCL 08G

Characteristic traits for earthquakes associated with strike-slip motion in Central California and the Salton Sea area, as revealed in ground based studies and LANDSAT imagery, were compared. The mapped lineaments are found to be oriented in several dominant directions. One direction is the same as the trend of the San Andreas fault. The other directions differ from area to area and may reflect the stresses of earlier geologic processes. The pattern of lineament orientations is significantly LANDSAT MSS data, SEASAT synthetic aperture radar data, and magnetic field data from the South Mountain area west of Gettysburg, Pennsylvania were registered to match each other in spatial position and merged. Pattern recognition techniques were applied to the composite data set to determine its utility in recognizing different rock types and structures in vegetated terrain around South Mountain. With the use of a texture algorithm to enhance geologic features, a classification of the entire area was made. A test of the correlation between SAR tone and texture, LANDSAT tone and texture, and magnetic field data revealed no tone or texture measures linking any two of the original data sets. A.R.H.

N84-15629*# Texas A&M Univ., College Station. Remote Sensing Center.
DEVELOPMENT OF VISIBLE/INFRARED/MICROWAVE AGRICULTURE CLASSIFICATION AND BIOMASS ESTIMATION ALGORITHMS, VOLUME 2 Final Report
Wesley D. Rosenthal, Marshall J. McFarland, Sidney W. Theis, and Cheryl L. Jones, Principal Investigators Feb. 1982 222 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS 3 Vol.
(Grant NsG-5134)
(E84-10059; NASA-CR-173140; NAS 1.26:173140; RSC-3458-130-Vol-2) Avail: NTIS HC A010/MF A01 CSCL 02C

Agricultural crop classification models using two or more spectral regions (visible through microwave) were developed and tested and biomass was estimated by including microwave with visible and infrared data. The study was conducted at Guymon, Oklahoma and Dalhart, Texas utilizing aircraft multispectral data and ground truth soil moisture and biomass information. Results indicate that inclusion of C, L, and P band active microwave data from look angles greater than 35 deg from nadir with visible and infrared data improved crop discrimination and biomass estimates compared to results using only visible and infrared data. The active microwave frequencies were sensitive to different biomass levels. In addition, two indices, one using only active microwave data and the other using data from the middle and near infrared bands, were well correlated to total biomass. Author

N84-15630*# Miami Univ., Fla. School of Marine and Atmospheric Science.
MAGNETIC ANOMALIES IN EAST PACIFIC USING MAGSAT DATA Final Report, Jun. 1980 - Jul. 1983
Christopher G. A. Harrison, Principal Investigator Sep. 1983 29 p
(E84-10060; NASA-CR-173141; NAS 1.26:173141) Avail: NTIS HC A03/MF A01 CSCL 08G

Methods for solving problems encountered in separating the core field from the crustal field are summarized as well as those methods developed for inverting total magnetic field data to obtain source functions for oceanic areas. Accounting for magnetization contrasts and the magnetization values measured in rocks of marine origin are also discussed. A.R.H.

N84-15631*# Pennsylvania State Univ., University Park. Dept. of Geosciences.
SYNTHESIS OF REGIONAL CRUST AND UPPER-MANTLE STRUCTURE FROM SEISMIC AND GRAVITY DATA Final Technical Report, 15 Jun. 1980 - 30 Nov. 1982
Shelton S. Alexander and Peter M. Lavin, Principal Investigators 30 Nov. 1982 193 p refs ERTS
(Grant NAG5-77)
(E84-10061; NASA-CR-173142; NAS 1.26:173142) Avail: NTIS HC A09/MF A01 CSCL 08G

Analyses of regional gravity and magnetic patterns, LANDSAT images and geological information revealed two major lineaments crossing western Pennsylvania and parts of surrounding states. These lineaments are inferred to be expressions of fracture zones which penetrare deeply into the crust and possibly the upper mantle. The extensions of the Tyron-Mt. Union and the Pittsburgh-Washington lineaments bound a distinct crustal block (Lake Erie-Maryland block) over 100 km wide and probably more than 600 km in length. Evidence exists for the lateral displacement of this block at least 60 km northwestward during late Precambrian to Lower Ordovician time. Subsequent movements have been mainly vertical with respect to neighboring blocks. A possible crustal block that passes through eastern Kentucky, proposed by a TVA study on tectonics in the southern Appalachians, was also investigated. Finally, the use of regional gravity and magnetic data

in identifying major crustal structures beneath western Pennsylvania is discussed. M.G.

N84-15632*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering and Computer Science.
SPATIAL REASONING TO DETERMINE STREAM NETWORK FROM LANDSAT IMAGERY Final Technical Report
R. M. Haralick, S. Wang, and D. B. Elliott 1983 16 p refs ERTS
(Grant NAG5-131)
(E84-10063; NASA-CR-175123; NAS 1.26:175123) Avail: NTIS HC A02/MF A01 CSCL 08G

In LANDSAT imagery, spectral and spatial information can be used to detect the drainage network as well as the relative elevation model in mountainous terrain. To do this, mixed information of material reflectance in the original LANDSAT imagery must be separated. From the material reflectance information, big visible rivers can be detected. From the topographic modulation information, ridges and valleys can be detected and assigned relative elevations. A complete elevation model can be generated by interpolating values for nonridge and non-valley pixels. The small streams not detectable from material reflectance information can be located in the valleys with flow direction known from the elevation model. Finally, the flow directions of big visible rivers can be inferred by solving a consistent labeling problem based on a set of spatial reasoning constraints. Author

N84-15633*# Arizona Univ., Tucson. Optical Sciences Center.
IN-FLIGHT ABSOLUTE RADIOMETRIC CALIBRATION OF THE THEMATIC MAPPER
K. R. Castle, R. G. Holm, C. J. Kastner, J. M. Palmer, P. N. Slater, M. Dinguirard (Centre d'Etudes et de Recherches de Toulouse), C. E. Ezra (Agricultural Research Service, Phoenix, Ariz.), R. D. Jackson (Agricultural Research Service, Phoenix, Ariz.), and R. Savage (Atmospheric Sciences Lab.) [1984] 10 p refs ERTS
(Contracts NAS5-27382; DI-12-14-5001-38)
(E84-10064; NASA-CR-173144; NAS 1.26:173144) Avail: NTIS HC A02/MF A01 CSCL 14B

In order to determine temporal changes of the absolute radiometric calibration of the entire TM system in flight spectroradiometric measurements of the ground and the atmosphere were made simultaneously with TM image collections over the White Sands, New Mexico area. By entering the measured values in an atmospheric radiative transfer program, the radiance levels in four of the spectral bands of the TM were determined, band 1:0.45 to 0.52 micrometers, band 2:0.53 to 0.61 micrometers band 3:0.62 to 0.70 micrometers and 4:0.78 to 0.91 micrometers. These levels were compared to the output digital counts from the detectors that sampled the radiometrically measured ground area, thus providing an absolute radiometric calibration of the entire TM system utilizing those detectors. A.R.H.

N84-15634*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL CHARACTERIZATION OF THE LANDSAT THEMATIC MAPPER SENSORS
Brian L. Markham and John L. Barker 1983 47 p refs Presented at the LANDSAT-4 Sci. Characterization Early Results Symp., NASA. Goddard Space Flight Center, 22-24 Feb. 1983 ERTS
(E84-10065; NASA-TM-85515; NAS 1.15:85515) Avail: NTIS HC A03/MF A01 CSCL 14/2

Data collected on the spectral characteristics of the LANDSAT-4 and LANDSAT-4 backup thematic mapper instruments, the protoflight (TM/PF) and flight (TM/F) models, respectively, are presented and analyzed. Tests were conducted on the instruments and their components to determine compliance with two sets of spectral specifications: band-by-band spectral coverage and channel-by-channel within-band spectral matching. Spectral coverage specifications were placed on: (1) band edges--points at 50% of peak response, (2) band edge slopes--steepness of rise and fall-off of response, (3) spectral flatness--evenness of response between edges, and (4) spurious system response--ratio of out-of-band response to in-band response. Compliance with the spectral coverage specifications was determined by analysis of spectral measurements on the individual components contributing to the overall spectral response: filters, detectors, and optical surfaces. M.G.

N84-15635*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
A CORRELATION ANALYSIS OF PERCENT CANOPY CLOSURE VERSUS TMS SPECTRAL RESPONSE FOR SELECTED FOREST SITES IN THE SAN JUAN NATIONAL FOREST, COLORADO
M. Kristine Butera Nov. 1983 30 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E84-10066; NASA-TM-85516; NSTL/ERL-212; DC-Y3-04440; NAS 1.15:85516) Avail: NTIS HC A03/MF A01 CSCL 02F

The correlation of canopy closure with the signal response of individual thematic mapper simulator (TMS) bands for selected forest sites in the San Juan National Forest, Colorado was investigated. Ground truth consisted of a photointerpreted determination of percent canopy closure of 0 to 100 percent for 32 sites. The sites selected were situated on plateaus at an elevation of approximately 3 km with slope $<$ or $=$ 10 percent. The predominant tree species were ponderosa pine and aspen. The mean TMS response per band per site was calculated from data acquired by aircraft during mid-September, 1981. A correlation analysis of TMS response vs. canopy closure resulted in the following correlation coefficients for bands 1 through 7, respectively: -0.757, -0.663, -0.666, -0.088, -0.797, -0.763. Two model regressions were applied to the TMS data set to create a map of predicted percent forest canopy closure for the study area. Results indicated percent predictive accuracies of 71, 74, and 57 for percent canopy closure classes of 0-25, 25-75, and 75-100, respectively. M.G.

N84-15636*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
ANALYSIS OF DATA ACQUIRED BY SYNTHETIC APERTURE RADAR OVER DADE COUNTY, FLORIDA, AND ACADIA PARISH, LOUISIANA
S. T. Wu Dec. 1983 45 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Original contains color imagery. Original photography may be purchased from EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Proj. AgRISTARS)
(E84-10067; NASA-TM-85517; NSTL/ERL-218; DE-Y2-04396; NAS 1.15:85517) Avail: NTIS HC A03/MF A01 CSCL 02C

Results of digital processing of airborne X-band synthetic aperture radar (SAR) data acquired over Dade County, Florida, and Acadia Parish, Louisiana are presented. The goal was to investigate the utility of SAR data for land cover mapping and area estimation under the AgRISTARS Domestic Crops and Land Cover Project. In the case of the Acadia Paris study area, LANDSAT multispectral scanner (MSS) data were also used to form a combined SAR and MSS data set. The results of accuracy evaluation for the SAR, MSS, and SAR/MSS data using supervised classification show that the combined SAR/MSS data set results in an improved classification accuracy of the five land cover classes as compared with SAR-only and MSS-only data sets. In the case of the Dade County study area, the results indicate that both HH and VV polarization data are highly responsive to the row orientation of the row crop but not to the specific vegetation which forms the row structure. On the other hand, the HV polarization data are relatively insensitive to the orientation of row crop. Therefore, the HV polarization data may be used to discriminate the specific vegetation that forms the row structure. M.G.

N84-15637*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
CLASSIFICATION AND AREA ESTIMATION OF LAND COVERS IN KANSAS USING GROUND-GATHERED AND LANDSAT DIGITAL DATA

George A. May, Martin L. Holko, and James E. Anderson Oct. 1983 14 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Prepared in cooperation with Dept. of Agriculture, Washington, D.C. Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Proj. AgRISTARS)
(E84-10068; NASA-TM-85518; NSTL/ERL-225; DC-Y3-04441; NAS 1.15:85518) Avail: NTIS HC A02/MF A01 CSCL 08B

Ground-gathered data and LANDSAT multispectral scanner (MSS) digital data from 1981 were analyzed to produce a classification of Kansas land areas into specific types called land covers. The land covers included rangeland, forest, residential, commercial/industrial, and various types of water. The analysis produced two outputs: acreage estimates with measures of precision, and map-type or photo products of the classification which can be overlaid on maps at specific scales. State-level acreage estimates were obtained and substate-level land cover classification overlays and estimates were generated for selected geographical areas. These products were found to be of potential use in managing land and water resources. M.G.

N84-15638# Bendix Field Engineering Corp., Grand Junction, Colo.
URANIUM ANOMALIES IN WYOMING AND PARTS OF ADJACENT STATES. NATIONAL URANIUM RESOURCE EVALUATION
C. S. Goodknight, J. R. Ludlam, J. A. Burger, R. E. Dickson, R. D. Dayvault, J. J. Dexter, and J. R. Anderson Dec. 1982 163 p refs
(Contract DE-AC13-76GJ-01664)
(DE83-005353; GJBX-3(83)) Avail: NTIS HC A08

Uranium anomalies in Wyoming and parts of adjacent states were identified. Data are from the hydrogeochemical and stream sediment reconnaissance (HSSR) and aerial radiometric reconnaissance (ARR) surveys for quadrangles and for smaller areas, data from individual quadrangle geologic evaluations (folios) for uranium favorability were also used. Multivariate statistical techniques were performed on the computer stored HSSR data. Machine generated maps and tables from statistical treatments of the HSSR and ARR data were the basis for screening for uranium anomalies. The maps were hand contoured, and uranium anomalies were chosen according to variable threshold values of data for each quandrangle. Areas designated as anomalous were evaluated by comparison to other NURE data, mainly the folios. The final anomalous areas were arranged in order of priority for each quadrangle according to the nature, magnitude, and amount of evidence corroborating the anomalous uranium concentrations. DOE

N84-15639# Massachusetts Inst. of Tech., Cambridge.
GROWTH PROCESSES OF SNOW Ph.D. Thesis. Final Report, 1 Nov. 1979 - 28 Feb. 1983
Kwok-Wai Kenneth Lo Hanscom AFB, Mass. AFGL May 1983 193 p
(Contract F19628-80-C-0021; AF Proj. 2310)
(AD-A133136; AFGL-TR-83-0105) Avail: NTIS HC A09/MF A01 CSCL 08/12

The growth of snow in winter storms is studied via observational and theoretical techniques. A new flight procedure termed the Advecting Spiral Descent (ASD) was employed by AFGL's instrumented C-130 aircraft to observe the height evolution of snow size spectra. These observations reveal that snow growth goes through three distinct stages: a vapor deposition stage, an aggregation stage and a secondary ice particle production stage. Theoretical models are used to simulate the observations of snow growth. These indicate that the secondary ice crystal production is due to the collisional breakup of snowflakes. Author (GRA)

N84-15640# Lamont-Doherty Geological Inst., Palisades, N. Y.
GEOPHYSICAL DATA FROM DRIFTING ICE STATIONS FRAM 4 AND TRISTEN
Werner Tiemann, Jay Ardai, Barry Allen, T. O. Manley, and Yngve Kristoffersen Dec. 1982 99 p
(Contract N00014-76-C-0004)
(AD-A133370; LDGO-82-3) Avail: NTIS HC A05/MF A01 CSCL 08/12

This report contains satellite navigation positioning, precision depth recorder (PDR) measurements, ice floe azimuths, and magnetic declinations collected by the Lamont Group at the FRAM IV drifting ice station. Gravity measurements at FRAM IV, taken by Yngve Kristoffersen of the Norsk Polarinstitutt, are incorporated into this report. Satellite navigation positioning and PDR data from the drifting ice station TRISTEN are also included in this report. Data are presented in the form of tables and figures with a brief description of the instrument and methods used in the obtaining and reducing the data prior to each section. Author (GRA)

N84-15641# Defense Mapping Agency, Washington, D.C.
THE FUTURE IN TERRAIN ELEVATION DATA PROCESSING AT THE DEFENSE MAPPING AGENCY Final Report
Robert B. Edelen Aug. 1983 8 p Presented at the 6th Intern. Automated Cartography Symp., Ottawa, 17-21 Oct. 1983
(AD-A133483) Avail: NTIS HC A02/MF A01 CSCL 08/2

Since 1968 the Defense Mapping Agency (DMA) has been actively engaged in the production of Digital Terrain Elevation Data; initially to support plastic relief mapping, then to support lines of site studies, and more recently to support advanced weapons systems, simulators and navigational devices. With the increasing variety of users for Digital Terrain Elevation Data (DTED), the requirement for greater quantity, accuracy and diversity of DTED has likewise increased. To help meet these challenging production requirements of the future, DMA has awarded a major contract for development of the Terrain Edit System/Elevation Matrix Processing System (TES/EMPS). The TES/EMPS will provide state-of-the-art mini computers, array processors and specially developed software to perform complex data transformation, interpolation, merging, and discrepancy detection functions. The TES/EMPS work stations, combined with mini computers and graphics processors, will provide advanced graphic displays and editing capabilities to perform interactive error correction, panelling and validation functions. All work flow through the system will be managed by the sophisticated job and file management software. The TES/EMPS will be installed at DMA in December 1983 and will perform all processing of DTED collected from photographic and cartographic sources. GRA

N84-15642# SRI International Corp., Menlo Park, Calif.
IMAGE UNDERSTANDING RESEARCH AND ITS APPLICATION TO CARTOGRAPHY AND COMPUTER-BASED ANALYSIS OF AERIAL IMAGERY Final Report, 5 Sep. 1979 - 30 Sep. 1983
Martin A. Fischler and Andrew J. Hanson Sep. 1983 107 p
(Contracts MDA903-79-C-0588; DARPA Order 3862)
(AD-A133495) Avail: NTIS HC A06/MF A01 CSCL 20/6

The authors' principal objective in this research program has been to obtain solutions to fundamental problems in computer vision that have broad military relevance, particularly in the areas of cartography and photo interpretation. Now-completed research has been directed towards developing automated techniques for stereo-compilation, delineation of linear features, scene partitioning, image matching, and image to database correspondence. In addition to their own research, the authors have designed and implemented an integrated testbed system that incorporates results of research produced throughout the Image Understanding community. This system provides a coherent framework for demonstration and evaluation of the accomplishments of DARPA's Image Understanding program, thereby facilitating transfer of this technology to appropriate military organizations. GRA

N84-15643# Anacapa Sciences, Inc., Santa Barbara, Calif.
EVALUATION OF MAP SYMBOLS FOR A COMPUTER GENERATED TOPOGRAPHIC DISPLAY: TRANSFER OF TRAINING, SYMBOL CONFUSION, AND ASSOCIATION VALUE STUDIES Interim Technical Report, Jul. - Dec. 1982
Christopher J. Jarosz and Steven P. Rogers Dec. 1982 117 p
(Contract DAAK80-81-C-0089)

(AD-A133590; AS-TR-459-5; AVAA-TR-81-0089-5) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report describes three studies conducted to evaluate the effectiveness of map symbols for a computer-generated topographic display. The criteria for developing symbol effectiveness were transfer of training, potential confusion, and association value. A computer-generated topographic display, or CGTD, utilizes a cathode ray tube (CRT), or other electronic display, to present map-like information. Conventional map symbols often are inapplicable with a CGTD because the matrix display elements, or 'pixels' does not provide sufficient resolution for portraying small and detailed shapes. As a part of the research described in this report, design guidelines were developed for creating symbols that meet the limitations of a pixel matrix display. Sixty-nine topographic and tactical symbols were developed for the candidate symbol set. The evaluation of symbol effectiveness was conducted by means of three surveys completed by military personnel. GRA

N84-15644# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.

LANDSAT 4 TM-DATA: EXAMPLES OF RESOLUTION CAPACITY

T. Orhaug, N. Olander, and E. Carlsson Sep. 1983 24 p refs (FOA-C-30329-E1; ISSN-0347-3708) Avail: NTIS HC A02/MF A01; Research Institute of National Defence, Stockholm KR 50

The LANDSAT 4 thematic mapper (TM) sensor is presented. Spectral, spatial and radiometric resolution is improved compared to Landsat Multispectral Scanner and return beam vidicon. Coarse examinations of the spatial resolution, using two urban scenes obtained with the TM-sensor indicate that it works well. Author (ESA)

N84-15645# North Carolina State Univ., Raleigh. Water Resources Research Inst.

USE OF LANDSAT MSS (MULTISPECTRAL SCANNER) DIGITAL DATA IN WATER QUALITY MAPPING OF THE NEUSE RIVER ESTUARY, NORTH CAROLINA

Khorram Siamak and Heather M. Cheshire May 1983 41 p refs (Contract DI-14-34-0001-2135)

(PB83-256750; UNC-WRRI-83-193; W83-03916; OWRT-A-125-NC(1)) Avail: NTIS HC A03/MF A01 CSCL 08H

LANDSAT multispectral scanner (MSS) digital data, and high resolution panoramic photography obtained from the Environmental Protection Agency's Enviropod were combined with surface measurements for water quality mapping of the Neuse River estuary, North Carolina. This constitutes the first effort to use LANDSAT digital data for mapping water quality parameters in this geographic area. The water quality parameters of interest included salinity, chlorophyll a, turbidity and total suspended solids. Temperature data were also recorded on site. The approach involved acquisition of water quality samples from boats at 75 sample sites simultaneous with LANDSAT satellite overpass. The results include a series of color-coded maps, each pertaining to one of the water quality parameters, along with the statistical summaries. GRA

N84-15646# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

PROPAGATION FACTORS AFFECTING REMOTE SENSING BY RADIO WAVES

Loughton Aug. 1983 399 p refs In ENGLISH and FRENCH Symp. held in Oberammergau, West Germany, 24-28 May 1983 (AGARD-CP-345; ISBN-92-835-0257-4) Avail: NTIS HC A17/MF A01

The purpose of the symposium was to survey progress in the field, and to bring together scientists and engineers working the different wavelength regions to encourage cross fertilization and to enable performance comparisons between systems. Satellite system factors and high frequency system factors are discussed. Radar tracking ice mapping, over the horizon radar, and backscattering are among the topics discussed. For individual titles, see N84-15647 through N84-15675.

N84-15647# European Space Agency, Toulouse (France). Remote Sensing Programme Div.

THE EUROPEAN SPACE AGENCY'S EARTH OBSERVATION SATELLITE PROGRAMMES

In AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 9 p (For primary document see N84-15646 06-43)

Avail: NTIS HC A17/MF A01

The European Space Agency's Earth observation programs are discussed. The Sirio-2 program, a system for meteorological data distribution mainly over Africa, and a laser synchronization experiment for time standards, is discussed. Emphases is placed on the elements of the remote sensing program in which mainly polar and quasi-polar, Sun-synchronous satellite orbits are used. The Earth network of ground stations, Spacelab, and ERS-1 are described. R.J.F.

N84-15648*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

REMOTE SENSING WITH SPACEBORNE SYNTHETIC APERTURE IMAGING RADARS: A REVIEW

J. B. Cimino and C. Elachi *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 16 p refs (For primary document see N84-15646 06-43)

(Contract NAS7-100)

Avail: NTIS HC A17/MF A01 CSCL 17I

A review is given of remote sensing with Spaceborne Synthetic Aperture Radars (SAR's). In 1978, a spaceborne SA was flown on the SEASAT satellite. It acquired high resulution images over many regions in North America and the North Pacific. The acquired data clearly demonstrate the capability of spaceborne SARs to: image and track polar ice floes; image ocean surface patterns including swells, internal waves, current boundaries, weather boundaries and vessels; and image land features which are used to acquire information about the surface geology and land cover. In 1981, another SAR was flown on the second shuttle flight. This Shuttle Imaging Radar (SIR-A) acquired land and ocean images over many areas around the world. The emphasis of the SIR-A experiment was mainly toward geologic mapping. Some of the key results of the SIR-A experiment are given. R.J.F.

N84-15649# Marconi Co. Ltd., Chelmsford (England).

OCEAN WAVE IMAGING BY SAR

S. Rotheram *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 20 p refs (For primary document see N84-15646 06-43)

Avail: NTIS HC A17/MF A01

SAR imagery of the sea surface contains wave-like features. The direct imaging problem is to describe the image of a given sea surface. Four approaches are given. These are linear imaging, Fourier series, functional expansion and asymptotic methods. Of particular interest is the loss of wave modulations due to nonlinear velocity bunching. The image power spectrum is analyzed using functional expansions and the azimuthal banding is explained by stochastic nonlinear velocity bunching. The theoretical results agree closely with SEASAT data and some examples are given. The inverse sea imaging problem is to describe the sea surface corresponding to a given image. Some preliminary results using linear inversion techniques are given. R.J.F.

N84-15650# SRI International Corp., Menlo Park, Calif.

PROPAGATION EFFECTS IN SATELLITE-BORNE SYNTHETIC APERTURE RADARS c32

C. L. Rino and V. H. Gonzalez *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p refs (For primary document see N84-15646 06-43)

(Contract DNA001-51-C-0010)

Avail: NTIS HC A17/MF A01

Satellite-borne synthetic aperture radars (SAR), such as SEASAT, can map large segments of the Earth's surface with a resolution better than 10 m. This high resolution is achieved by processing data coherently from a 10-to-20 km path along the satellite orbit. SEASAT operates at L band, where severe, naturally

occurring propagation disturbances are rare except near the geomagnetic equator. On the other hand, because of the large aperture involved, loss of spatial coherence of phase can occur even when no significant amplitude scintillation is present. Computations were made that model the distortion of a point target for typical high-latitude scintillation conditions. The results show that severe degradation of reconstructed SAR images can occur, on occasion, from natural ionospheric disturbances. To confirm these results, the SEASAT data base was searched for obvious examples of the kind of distortion expected. Several examples were found. Through a fortunate coincidence, incoherent-scatter radar data were available in which the likely source region of one of the disturbances was identified. R.J.F.

N84-15651*# Kansas Univ., Lawrence. Remote Sensing Lab.
RADAR AND INFRARED REMOTE SENSING OF TERRAIN, WATER RESOURCES, ARCTIC SEA ICE, AND AGRICULTURE
Albert W. Biggs *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 22 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

Radar range measurements, basic waveforms of radar systems, and radar displays are initially described. These are followed by backscatter from several types of terrain and vegetation as a function of frequency and grazing angle. Analytical models for this backscatter include the facet models of radar return, with range-angle, velocity-range, velocity-angle, range, velocity, and angular only discriminations. Several side-looking airborne radar geometries are presented. Radar images of Arctic sea ice, fresh water lake ice, cloud-covered terrain, and related areas are presented to identify applications of radar imagery. Volume scatter models are applied to radar imagery from alpine snowfields. Short pulse ice thickness radar for subsurface probes is discussed in fresh-water ice and sea ice detection. Infrared scanners, including multispectral, are described. Diffusion of cold water into a river, Arctic sea ice, power plant discharges, volcanic heat, and related areas are presented in thermal imagery. Multispectral radar and infrared imagery are discussed, with comparisons of photographic, infrared, and radar imagery of the same terrain or subjects. R.J.F.

N84-15652# Laboratoire d'Etude des Transmissions Ionospheriques, Cachan (France).
ADAPTIVE PROTECTION OF DETECION SYSTEMS OPERATING BY SPREAD SPECTRUM [PROTECTION ADAPTIVE DES SYSTEMES DE DETECTION FONCIONNANT PAR ETALEMENT DE SPECTRE] **c74**
C. Goutelard and A. Joisel *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs In FRENCH; ENGLISH summary (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

Spectral congestion in the decametric range (3 - 30MHz) is such that jamming (whether voluntary or involuntary) is now an important parameter in propagation. To reduce or eliminate such jamming effects, frequency filtering or spatial filtering (with or without nulling antennas) may be used, separately or together. The spectral spreading technique is well known in telecommunications and teledetection. Whenever the perturbing signal spectrum range is smaller than that of the useful signal, a simple band filter reduces jamming, but this alters the spectrum of the received signal and that modifies its ambiquity function. Such deterioration may be avoided by introducing a non-linear operator. The limiting factors are essentially the technological constraints for the material, in particular treatment time and dynamic. The system performance is illustrated in experimental results and may be compared with the results obtained using classical techniques. Author

N84-15653# Laboratoire d'Etude des Transmissions Ionospheriques, Cachan (France).
CONTENDING WITH JAMMING IN DECAMETRIC WAVES IN AN ADAPTIVE SYSTEM OF ALL-DIRECTIONAL ANTENNAS [LUTTE CONTRE LE BROUILLAGE EN ONDES DECAMETRIQUES DANS UN SYSTEME D'AERIENS ADAPTIF ORIENTABLE TOUT AZIMUT] **c32**
C. Goutelard and A. Joisel *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 14 p refs In FRENCH; ENGLISH summary (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

Panoramic observation in space using decametric wave radar raises the problem radiating lobe orientation. The desired angular resolutions (about 1 deg) fix the system dimensions, and necessitate electronic orientation of the beam. Two major techniques are employed. The first consists in an alignment array which allows a limited sector to be explored with resolutions of less than one degree. Panoramic exploration requires the use of several systems. The second technique consists in the use of networks possessing rotational symetry and equiped with omnidirectional radiation antennas, or "log periodic" type antennas. Resolution is of the order of a few degrees and secondary lobe protection is only modest. An all-directional exploration system is described, using a surface array. Resolution is of the order of a few degrees but there is considerable protection of the secondary lobes. The "nulling pattern antennas" technique can be associated with the system to ensure jamming protection. Author

N84-15654# Rome Air Development Center, Hanscom AFB, Mass. Electromagnetic Sciences Div.
HF OVER-THE-HORIZON MAPPING OF THE GREENLAND ICECAP
Gary S. Sales *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

Continuous observation of the Greenland area using a high frequency over-the-horizon Sounding system in the North Atlantic region produced a data base for the analysis of backscatter reflectivity at high frequencies (6-30 MHz) from the Greenland Icecap. The proximity of these observations to the auroral region generated the additional complication of excess losses due to D-region absorption. This statistical data base produced a mapping of the icecap thickness, with backscatter reflectivities that vary from -5 dB to -15 dB below the signals returned from the surrounding sea water. A statistically meaningful daytime absorption of the order of 5 dB was measured over Greenland. At night the significantly increased auroral absorption and atmospheric noise, reduced the system's sensitivity, making mapping impossible. R.J.F.

N84-15655# Birmingham Univ. (England). Dept. of Electronic and Electrical Engineering.
A REVIEW OF PROPAGATION AND SCATTERING FACTORS IN REMOTE-SENSING AND SHIP-TRACKING BY HF RADAR **c32**
E. D. R. Shearman *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

The propagation-loss, noise and scattering mechanisms involved in ground-wave radar for sea state sensing and ship-tracking are first reviewed, taking as an example a coastal installation in the U.K. Techniques for extracting surface-current, surface-wind and directional sea-wave spectrum from first and second-order sea-echo are described, with reference to the influence of the antenna directivity and propagation factors. The special factors affecting ship-tracking in range, azimuth and Doppler are illustrated. The use of sky-wave radar for sea-state sensing and for assessing the ionospheric layer configuration and propagation mode patterns is discussed. Sea-state sensing is shown to require real-time propagation assessment for effective frequency-management. Rapid sweep frequency, sweep-azimuth and Doppler analysis are shown to be desirable. R.J.F.

N84-15656# Science Research Council, Chilton (England).
IONOSPHERIC FACTORS AFFECTING THE PERFORMANCE OF HF SKY-WAVE SEA-STATE RADARS **c32**

P. A. Bradley, E. N. Bramley, A. J. Gibson, and J. W. King *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 10 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

This paper contains an assessment, partly theoretical and partly based on observations, of the impact of various ionospheric factors on the usefulness of the HF sky-wave sea-state radar technique. The points discussed include the following: (1) The ionospheric propagation modes available will not permit all parts of the ocean which it is desired to investigate to be illuminiated at all times in such a way that good-quality Doppler spectra are obtained. Es-mode propagation generally results in good-quality Doppler spectra from which information about the sea waves can be inferred, but F-mode propagation yields poor spectra which can only be used to deduce the surface wind direction. (2) Doppler shifts associated with vertical ionospheric motions give spectral contamination which limits the amount of information that can be derived. Spectral contamination also arises under conditions of multi-mode propagation and when high- and low-angle rays are present. (3) Lack of knowledge of the height of reflection of the sky-wave signals means that the area of ocean probed cannot be located accurately. (4) The azimuthal spreading (arising because of the antenna beam width) and range spreading (caused by ionospheric tilts and corrugations and associated with the finite radar pulse width) both result in Doppler contamination of the returned signals. Author

N84-15657# Communications Research Centre, Ottawa (Ontario).
THE CANADIAN PROGRAMME OF EXPERIMENTAL MEASUREMENT OF SEA-STATE CHARACTERISTICS BY SKY-WAVE RADAR c32
E. L. Winacott, C. Roche (Centre for Cold-Ocean Resources Engineering, St. Johns, Newfoundland), and J. Y. K. Chan (Miller Communications Systems, Ottawa) *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 17 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

In June, 1980, a limited programs of sky-wave radar measurements was undertaken to investigate the feasibility of measuring sea-state characteristics off the coast of Newfoundland. The program involved the collection of data by the Communications Research Centre's (CRC) Sampled Aperture Receiving Array (SARA) facility at Ottawa, the compilation of ground-truth maps of wave height, wind velocity and ice coverage by the Centre for Cold-Ocean Resources Engineering (C-CORE) in Newfoundland, and data analysis and interpretation by both agencies. A number of day-time experimental runs were made between October, 1980, and April, 1982. Because it was felt that ionospheric disturbances would preclude the recording of useful results, runs were made, as much as possible, only during periods of relatively quiet ionospheric conditions. As was expected from the earlier experience of U.S. workers, maps of wind direction usually could be derived from the data, but maps of wave heights were quite sparse: less than one-quarter of the data were useful. In fact, since the acceptance criterion developed by the U.S. workers was found to reject virtually all of the Canadian data; a manual acceptance technique had to be employed. While this technique has made possible the recovery of experimental results, it would be impractical in an operational radar. Determination of other sea-state characteristics, such as sea-wave spectra, the magnitude of the swell component or independent measurement of wind speed, was not possible from the data collected. B.W.

N84-15658# Naval Ocean Systems Center, San Diego, Calif. Ocean and Atmospheric Sciences Div.
F-REGION VARIABILITY AND HF-PROPAGATION c32
Adolf K. Paul *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

A program conducted during the winter 1980/1981 in Brighton, Colorado, with a modern digital ionosonde was aimed towards improvement of knowledge regarding the temporal variations. Rapid sequences of ionograms were taken in irregular intervals and the analysis concentrated mainly on the maximum usable frequency MUF (3000) as a very sensitive combined indicator for variations in height and electron density. This quantity could be computed automatically with very high precision. Other quantities obtained were the critical frequency of the F-region, estimates for its height of maximum and half thickness, Doppler velocity and angle of arrival. Some of the results are: short term variations of the MUF (3000) can have much larger amplitudes than previously expected from hourly data. Changes close to 50 percent within half an hour were observed. No correlation between gravity wave activity and magnetic activity could be found. There is some indication that high gravity wave activity is caused by severe weather systems. Local tilts of 5 deg and more were observed during periods of high gravity wave activity. The area of high or low gravity wave activity seems to be very large (more than 1000 km radius). B.W.

N84-15659# Lowell Univ., Mass. Center for Atmospheric Research.
AUTOMATIC ELECTRON DENSITY PROFILES FROM DIGITAL IONOGRAMS c32
Bodo W. Reinisch, Robert R. Gamache, and Jane S. Tang *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 11 p refs (For primary document see N84-15646 06-43)
(Contract F19628-80-C-0064)
Avail: NTIS HC A17/MF A01

Over-the-horizon HF radar detection and sea state monitoring require fairly precise knowledge of the ionospheric reflection point. Automatic scaling of ionograms and calculation of the vertical electron density profile can provide the reflection point characteristics in real time if adequate ionosondes are available at the expected mid-points. The automatic scaling algorithm developed at the University of Lowell extracts the E and F region traces from Digisonde ionograms without any human intervention and automatically produces the corresponding electron density profiles. The algorithm was tested on several thousand Digisonde ionograms covering the four seasons, day, night, quiet and disturbed conditions, as observed at the AFGL Ionospheric Observatory, Goose Bay, Labrador. All important ionospheric parameters are automatically retrieved: foF2, foF1, fminF, MUF(3000), M(3000), range spread, frequency spread, h'F, h'F2, foE, foEs, fminE, h'Es, and signal amplitude as function of frequency. The electron density profile algorithm uses a polynomial profile-fitting method and is part of the automatic procedure. Author

N84-15660# Hulburt (E. O.) Center for Space Research, Washington, D.C. Ionospheric Effects Branch.
DETERMINATION OF PROPAGATION LIMITATIONS AT HF BY REAL-TIME UPDATE OF A COMPUTER MODEL FROM OBLIQUE SOUNDER DATA c32
Donald R. Uffelman *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

The Naval Research Laboratory has an active program which involves an assessment of the HF propagation channel by coupling computer models of the channel to data obtained from oblique sounders. Currently, this technique draws upon models of maximum usable frequency (MUF) resident in programs such as IONCAP and the Naval Ocean Systems Center (NOSC) PROPHET SYSTEM (MINIMUF 3.5) and relates this model to real-time measurements of the maximum observed frequency (MOF) over a reference path. Measurements from the reference path are used to update the models and the driving parameters which are ascertained from this process are used to access the maximum observed frequency over paths disjoint from the reference path. In the experimental approach, NRL employs a network of oblique sounders to determine the success of the technique. One link in the network is designated the control path and the other links are designated as experimental paths to which the results of the model update are compared. The comparison criterion is rms error between the modelled

parameters and the measurements of those same parameters over the various links. Initial results indicate that for F-region propagation near the maximum observed frequency under benign and moderately disturbed conditions, update of the MINIMUF model improves performance by as much as a factor of four. The results for the IONCAP are much less encouraging, at least in this case, however. It is suggested that this approach could be utilized in selective calling systems as well as automated frequency control of systems such as that being developed for Project Cross Fox. Author

N84-15661# Hulburt (E. O.) Center for Space Research, Washington, D.C. Ionospheric Effects Branch.
ON THE UTILIZATION OF IONOSPHERIC DIAGNOSTICS IN THE SINGLE-SITE LOCATION OF HF EMITTERS c32
John M. Goodman and Donald R. Uffelman *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

The Naval Research Laboratory conducted an experiment during the latter half of calendar year 1982 which dealt with the problem of HF Single-Site-Location (SSL) as envisioned for the U.S. Army Rear Echelon HF Comint System (RECS). This experiment was conducted for the purpose of certifying a baseline SSL system and the test was identified simply as the SSL-BCT (Baseline Certification Test). Two specific approaches to SSL were examined during the experiment which was conducted from a base station located at Fort Ord, California. For the most part the desire was to examine two competing SSL techniques in an environment which simulated an actual operational situation, viz., a single-blind experiment. As control, however, there was a period (Phase 1) during which each competing technique was calibrated against known HF emitters. Measurements were made using a variety of emitters located at short, medium, and moderately long ranges to the east of Fort Ord. The results of these tests, in which systems developed by Southwest Research Institute and Technology for Communications International were exercised, have not yet been released. However, generalized conclusions have been reached. To be assured that the ionospheric channel was properly specified, the SSL-BCT test range was instrumented as fully as possible. Oblique ionosondes, vertical incidence ionosondes, Faraday rotation polarimeters, and satellite-borne topside sounders were used for the purpose of ionospheric specification. This paper describes the general SSL-BCT approach and the type of results which were obtained but it emphasizes the various approaches to ionospheric specification required for optimum SSL operation. Author

N84-15662# General Electric Co., Syracuse, N.Y.
EXTRATERRESTRIAL RADIO NOISE AND ITS EFFECT ON RADAR PERFORMANCE c32
George H. Millman *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 8 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

In this paper, the flux densities of radio frequency radiation from the quiet Sun and other cosmic noise sources are presented as a function of frequency. The conversion of flux density to apparent antenna temperature is discussed. An evaluation is made of UHF radar system degradation, i.e., the reduction of radar-range capability, due to the presence of the Sun, discrete radio stars and distributed noise sources in the Galaxy. Author

N84-15663# Royal Norwegian Council for Scientific and Industrial Research, Kjeller. Environmental Surveillance Technology Programme.
MULTIFREQUENCY SCATTERING FOR TARGET CHARACTERIZATION AND IDENTIFICATION: A SUMMARY OF RECENT RESULTS c32
Dag T. Gjessing *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 8 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

An optimum illumination and detection system which is capable of adapting itself to target against a terrestrial background through an adverse propagation medium is described in depth. This is multifrequency radar system, lends itself directly to simple computer control in a manner which is very familiar to the computer scientist. Results from simple mathematical models are presented and some preliminary experimental verifications are offered. B.W.

N84-15664# Illinois Univ., Urbana-Champaign. Dept. of Electrical Engineering.
THE EFFECT OF TURBULENT ATMOSPHERE ON BACKSCATTERED WAVES c32
K. C. Yeh and C. H. Liu *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 6 p refs (For primary document see N84-15646 06-43)
(Grant NSF ATM-82-08931)
Avail: NTIS HC A17/MF A01

In radar detection of targets the backscattered waves are traveling through the same region as the incident wave. When the region is occupied by a turbulent atmosphere, the backscattered wave is therefore expected to be correlated with the incident wave. As a matter of fact, these two oppositely traveling waves are related through a reciprocity theorem. This reciprocity theorem is shown to be valid by using the Feynman path integral solution of the parabolic equation. For the problem at hand the path integral is just the propagator which enters naturally in calculations of the mutual coherence function. This mutual coherence function is evaluated for several cases: when the incident wave is a narrow or broad beam wave, and when the target is a single point or a random reflecting screen with finite correlation size. The aperture averaged mutual intensities are also evaluated. The results show that under certain conditions the backscattered power can be intensified to above the free space value. The turbulent atmosphere can also broaden the apparent target size under some other conditions. These and other results will be presented and discussed in the paper. Author

N84-15665# TRW Space Technology Labs., Redondo Beach, Calif.
THE NATURE OF MICROWAVE BACKSCATTERING FROM WATER WAVES c32
S. W. Kwoh and B. M. Lake *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 16 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

A recent laboratory study shows that Bragg scattering by itself is not a adequate description for microwave backscattering from water waves. It may account for part of the scattering, but reflection from specular facets and wedge-like diffractive scattering from small radius crests of waves can predominate. Two experiments were performed. The first experiment was performed on wave paddle-generated short gravity waves. Using a scanning laser slope gauge to measure the surface and the moments method to compute the scattering, it was found that the small radius crests of such waves can be the more dominant source of scattering and that the description of such scattering is closer to wedge diffraction than Bragg scattering. The second experiment was performed on wind waves. It was found that at low wind the Doppler spectrum is narrow peaked but it gradually evolves to become a doubly peaked spectrum at high wind. Analysis shows that low wind scattering is indeed Bragg scattering. At high wind, the lower frequency peak again is due to Bragg scattering from rough patches, whereas the higher frequency peak is due to scattering from waves not unlike the paddle-generated short gravity waves. B.W.

N84-15666# Laboratoire Central de Telecommunications, Paris (France).
MULTIPLE PATHS ON THE OCEAN SURFACE [TRAJETS MULTIPLES SUR LA SURFACE DE LA MER] c32
Michel Fournier *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 17 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

A realistic model of propagation affected by multiple paths on the sea surface is considered in an effort to develop a computer program for use in studying systems work operating in such an environment. The compatibility of laws of hydrodynamics with those of statistics are examined in order to obtain an appropriate description of the sea surface. A linear model is proposed and its validity is assessed. The statistics of a diffuse signal in the ocean surface environment are obtained for direct signals, coherent signals, and diffuse signals. The choice of an electromagnetic theory to describe the effects of backscattering is explored. The model proposed describes as correctly as possible the spatio-temporal correlation of the signal and introduces oceanographic data from experiments. Transl. by A.R.H.

N84-15667# Racal-Decca Ltd., Chessington (England).
10 cm RADAR GROUND CLUTTER MEASUREMENTS TAKEN FROM A COASTAL STEAMER RADAR ON PASSAGE FROM BERGEN TO NORTH CAPE IN MAY 1982 c32
P. D. L. Williams *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 15 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

The range of R.C.S. values from a high rising natural coastline viewed by radar on a ship proceeding along that coast from 1 to 10 miles away. The range of R.C.S. values from the mountainous country just inland of the first coastal echo. The likely range of spatial filling factor of inland ground clutter and radar detection of aircraft flying overland in these regions using interclutter visibility rather than classic DOPPLER MTI methods of "sub clutter" detection are addressed. Author

N84-15668# Segnalamento Marittimo ed Aereo S.p.A., Florence (Italy).
STATISTICAL DATA ON ANOMALOUS PROPAGATION IN THE TYRRHENIAN SEA USING AN X-BAND LINK c32
V. Sacco, P. P. Lombardini, and G. Marsiglia *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 7 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

Anomalous propagation is heavily dependent on climate. The Mediterranean climate is particularly rich on ducting phenomena. An X-band link has been established between Vesima, near Genoa (transmitter) and Leghorn (receiver) with the intent of gathering data on existence and repeatibility of ducting in the Tyrrhenian Sea. The link distance is 87.5 nautical miles. The heights of the transmitting and the receiving antenna are 5 mt. over the sea level. Data of signal intensity are recorded every half hour. Data and evaluations from a first period of working are presented. Also a relationship between ducting and climatic stability is presented. Author

N84-15669# Marconi Co. Ltd., Great Baddow (England).
A LONG RANGE PROPAGATION EXPERIMENT TO INVESTIGATE THE INCIDENCE OF ANOMALOUS PROPAGATION IN THE NORTH ATLANTIC c32
G. C. Rider and J. Clarke (Royal Signals and Radar Establishment, Malvern, England) *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

The significance of enhanced range on air to ground paths is reviewed and the paper describes an experiment to collect maximum range data on an oversea path. A Secondary Surveillance Radar sited in the Hebrides was used to observe civil air traffic crossing the North Atlantic, and a cumulative distribution of range extending to 0.1% of the year is presented as a result of 14 months of observation. The modifications made to the radar antenna and display in order to provide sufficient system sensitivity, are described. About 99% of the observations are shown to be satisfactorily modelled by employing an exponential atmosphere with linear N profiles as measured by a suitably sited radiosonde station, Ocean Weather Ship 'L', to model the first 1 Km. of height. The remaining 1% of observations, the extreme range cases, are examined in some detail and are attributed with reasonable confidence to ray bending in passage through elevated layers. Author

N84-15670# Arete Associates, Inc., Encino, Calif.
LIDAR REMOTE SENSING OF INTERNAL WAVES AND OPTICAL PROPERTIES
Stephen C. Lubard, Lawrence R. Thebaud, and Richard F. Lutomirski (Pacific Sierra Research Corp., Los Angeles) *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

The theoretical basis and recent experimental results on the remote sensing capability of a lidar probing down into the ocean are summarized. The emphasis will be on the detection of modulations in the lidar return induced by the internal wave displacement field. The experiment included a high precision lidar operated through a plexiglass window flush with the keel of a drifting ship. Internal waves were measured simultaneously and nearly coincidentally with a chain of thermistors. Measured ocean optical properties included vertical profiles of beam attenuation coefficient, (spectral) diffuse attenuation coefficient, point spread function and local particulate backscattering versus time at several depths. Coherences between the lidar return at various depths and internal wave displacements have been determined for several blocks of data and indicate detections of internal wave induced modulations in the lidar return. Author

N84-15671# Science Applications, Inc., San Diego, Calif.
SATELLITE MEASUREMENTS OF MARINE AEROSOLS
Michael Griggs *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 5 p refs (For primary document see N84-15646 06-43)
(Contracts N00014-77-C-0489; N00228-82-C-6199; MO-A01-78-00-4092)
Avail: NTIS HC A17/MF A01

The ability to measure atmospheric aerosols over ocean surfaces was demonstrated using several different satellite sensors. LANDSAT data originally showed that a linear relationship exists between the upwelling visible radiance and the aerosol optical thickness. Analysis of NOAA-6 AVHRR data obtained at several different locations, in coincidence with ground truth measurements, show that the Channel 1 (0.65 microns) radiances can be used to determine the aerosol optical thickness. The good agreement between the results at different locations suggests that the technique could be used in an operational system. A technique using Channel 1 and Channel 2 (0.86 microns) radiances to determine the aerosol size distribution is discussed, and, in spite of uncertainties in the satellite and ground truth data, a preliminary analysis shows that useful estimates of the size distribution can be obtained. Author

N84-15672# Tetra Tech, Inc., Pasadena, Calif.
TECHNIQUES FOR MEASURING RADIANCE IN THE AIR AND SEA
Willard H. Wells *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 17 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

Measurements of scattered sunlight often employ simple radiometers that are incapable of scanning azimuth phi and zenith angle theta. Instead, they measure integral moments of the radiance. Consider a set of N+1 meters designed to measure moments lambda sub 1 through lambda sub N+1. If each meter is judiciously designed, then the lambda sub j may be processed quite simply to deduce inherent properties of the scattering medium, namely N moments of the volume scattering function. In the optimum design, each meter has an angular response that approximates a polynomial of degree N in cos theta. The theory of these meters is based on Boltzmann's equation of radiative transfer expressed in terms of spherical harmonics, a form in which this equation is particularly simple. Author

N84-15673*# Scripps Institution of Oceanography, La Jolla, Calif. Visiblity Lab.
PASSIVE REMOTE SENSING OF OCEAN OPTICAL PROPAGATION PARAMETERS **c48**
Roswell W. Austin and Benjamin L. McGlamery *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 11 p refs (For primary document see N84-15646 06-43)
(Contracts NAS5-26249; N00014-78-C-0566)
Avail: NTIS HC A17/MF A01

A method is described for producing a global data of ocean optical properties through the exploitation of optical remote sensing techniques. The diffuse attenuation, K, and the radiance reflectance factor R sub L, of the ocean surface waters can be derived from the radiance data provided by the Coastal Zone Color Scanner and compiled into a computer based atlas of these properties. While these remotely sensed values can only be directly related to the water properties in the first or upper attenuation length, extensive in water measurements have demonstrated that a useful correlation exists between the K that applies to the upper attenuation length, for example, and the mean K over the upper 100 or 200 meters of the ocean. Such an empirical finding greatly enhances the usefulness of this remotely sensed propagation parameter. Examples of the type of information being produced and archived for the atlas are presented. Author

N84-15674# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF ATMOSPHERIC PRESSURE AND SEA STATE FROM SATELLITES USING SHORT-PULSE MULTICOLOR LASER ALTIMETERS **c36**
Chester S. Gardner, Bin-Min Tsai, and James B. Abshire *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 11 p refs Prepared in cooperation with Illinois Univ., Urbana (For primary document see N84-15646 06-43)
(Grant NsG-5049)
Avail: NTIS HC A17/MF A01 CSCL 20E

Short pulse multicolor laser ranging systems are currently being developed for satellite ranging applications. These systems use Q-switched pulsed lasers and streak tube cameras to provide timing accuracies approaching a few picoseconds. Satellite laser ranging systems was used to evaluate many important geophysical phenomena such as fault motion, polar motion and solid earth tides, by measuring the orbital perturbations of retroreflector equipped satellites. Some existing operational systems provide range resolution approaching a few millimeters. There is currently considerable interest in adapting these highly accurate systems for use as airborne and satellite based altimeters. Potential applications include the measurement of sea state, ground topography and atmospheric pressure. This paper reviews recent progress in the development of multicolor laser altimeters for use in monitoring sea state and atmospheric pressure. Author

N84-15675# SRI International Corp., Menlo Park, Calif.
IN SITU CHARACTERIZATION OF SEAWATER USING A COMPUTERIZED SUITE OF OPTICAL INSTRUMENTS **c48**
Richard C. Honey and Chester A. Moore *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

A suite of instruments is described that measures the parameters required as sea truth for a shipborne lidar system. Novel optical configurations are used with digital electronics to efficiently measure beam transmission, backscattering, beam spread function, and diffuse spectral attenuation. All sensors are linked to a single desktop computer for data collection and analysis in near real time at sea. The instrumentation is described, and representative data are presented. Author

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N84-15676# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DEVELOPMENT OF A CONSENSUS STANDARD FOR DETERMINING THERMAL PERFORMANCE OF HIGH-CONCENTRATION-RATIO SOLAR COLLECTORS
J. B. Blackmon, M. C. Linskens (Midwest Research Inst.), and K. A. Reed (National Bureau of Standards) Dec. 1982 7 p refs Presented at the 6th Ann. ASME Tech. Conf. on Com. Building Heating and Cooling Appl., Orlando, Fla., 19-21 Apr. 1983
(Contract EG-77-C-01-4042)
(DE83-005129; SERI/TP-253-1839; CONF-830405-8) Avail: NTIS HC A02

Consensus standard test method, for determining the thermal performance of concentrating solar collectors is described. The method applies to outdoor testing of one or two axis concentrating collectors with heat fluids for use in thermal systems and whose design is such that the effects of diffuse sky irradiance is negligible. The procedures determine the optical response of the collector for various angles of incidence of solar radiation, and the thermal performance of the collector at various operating temperatures for the condition of maximum optical response. The method requires quasi steady state conditions, measurement of enviromental parameters, and determination of the fluidmass flow rate specific heat product and temperature difference of the heat transfer fluid between the inlet and outlet of the collector. These quantities determine the rate of heat gain for the solar irradiance condition encountered. Thermal performance is determined as the rate of heat gain of the collector relative to the solar power incident on the plane of the collector aperture. DOE

N84-15677# Systems Control, Inc., Palo Alto, Calif.
ASSESSMENT OF LOAD-FREQUENCY-CONTROL IMPACTS CAUSED BY SMALL WIND TURBINES
D. H. Curtice and T. W. Reddoch 1982 11 p refs Presented at the IEEE Power Engr. Soc. Winter Meeting, New York, 30 Jan. 1982 Submitted for publication
(Contract W-7405-eng-26)
(DE82-011513; CONF-820134-1) Avail: NTIS HC A02

A method is presented to analyze the effects small wind turbines' (WTs) output may have on the load frequency control process. A simulation model of a utility's automatic generation control (AGC) process is used with recorded real time system load data modified by synthesized data characterizing the aggregate output of small WTs. A series of WT output scenarios are defined for various WT penetrations of the total system load. WT output scenarios, varying in frequency and magnitude, are combined with system load variations to test the effectiveness of present AGC control strategies. System performance change from the base case is assessed using area control error (ACE) values, time between zero crossings, inadvertent accumulation, and control pulses sent to regulating units. DOE

N84-15678# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
DIRECT STEAM GENERATION IN LINE-FOCUS SOLAR COLLECTORS
E. K. May and L. M. Murphy Jan. 1983 10 p refs Presented at the ASME Solar Energy Div. 6th Ann. Tech. Conf., Orlando, Fla., 19-21 Apr. 1983
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)

(DE83-006030; SERI/TP-253-1870; CONF-830405-12) Avail: NTIS HC A02/MF A01

The performance benefits of the direct (in situ) generation of steam in the receiver tube of a line focus solar collector were assessed. Compared to existing technology using steam flash or unfired boiler systems, the in situ technique could produce 25% more steam at a reduced delivery cost. It is indicated that two phase flow instabilities, if present, can be readily controlled, and that the possibility of freezing is not an impediment to using water in cold climates. DOE

N84-15679*# Institute of Gas Technology, Chicago, Ill.
HIGH-TEMPERATURE MOLTEN SALT THERMAL ENERGY STORAGE SYSTEMS FOR SOLAR APPLICATIONS
Randy J. Petri, Terry D. Claar, and Estela Ong Jul. 1983 171 p refs
(Contract DEN3-156)
(NASA-CR-167916; DOE/NASA/0156/83-1; NAS 1.26:167916) Avail: NTIS HC A08/MF A01 CSCL 10C

Experimental results of compatibility screening studies of 100 salt/containment/thermal conductivity enhancement (TCE) combinations for the high temperature solar thermal application range of 704 deg to 871 C (1300 to 1600 F) are presented. Nine candidate containment/HX alloy materials and two TCE materials were tested with six candidate solar thermal alkali and alkaline earth carbonate storage salts (both reagent and technical grade of each). Compatibility tests were conducted with salt encapsulated in approx. 6.0 inch x 1 inch welded containers of test material from 300 to 3000 hours. Compatibility evaluations were end application oriented, considering the potential 30 year lifetime requirement of solar thermal power plant components. Analyses were based on depth and nature of salt side corrosion of materials, containment alloy thermal aging effects, weld integrity in salt environment, air side containment oxidation, and chemical and physical analyses of the salt. A need for more reliable, and in some cases first time determined thermophysical and transport property data was also identified for molten carbonates in the 704 to 871 C temperature range. In particular, accurate melting point (mp) measurements were performed for Li2CO3 and Na2-CO3 while melting point, heat of fusion, and specific heat determinations were conducted on 81.3 weight percent Na2CO3-18.7 weight percent K2CO3 and 52.2 weight percent BaCO3-47.8 weight percent Na2CO3 to support future TES system design and ultimate scale up of solar thermal energy storage (TES) sub-systems. Author

N84-15680# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
THE SERI ADVANCED AND INNOVATIVE WIND ENERGY CONCEPTS PROGRAM
Richard L. Mitchell and Eric W. Jacobs Jun. 1983 12 p refs Presented at the Ann Meeting of the Am. Solar Energy Soc., Minneapolis, 1-3 Jun. 1983
(Contract EG-77-C-01-4042)
(DE83-011960; SERI/TP-211-1984) Avail: NTIS HC A02/MF A01

In 1978 the Solar Energy Research Institute (SERI) was given the responsibility of managing the Advanced and Innovative Wind Energy Concepts (AIWEC) Task by the U.S. Department of Energy (DOE). The objective of this program has been to determine the technical and economic potential of advanced wind energy concepts. Assessment and R&D efforts in the AIWEC program have included theoretical performance analyses, wind tunnel testing, and/or costing studies. Concepts demonstrating sufficient potential undergo prototype testing in a Proof-of-Concept research phase. Several concepts, such as the Dynamic Inducer, the Diffuser Augmented Wind Turbine, the Electrofluid Dynamic Wind-Driven Generator, the Passive Cyclic Pitch concept, and higher performance airfoil configurations for vertical axis wind turbines, have recently made significant progress. The latter has currently reached the Proof-of-Concept phase. The present paper provides an overview of the technical progress and current status of these concepts. Author

N84-15681*# Case Western Reserve Univ., Cleveland, Ohio. Center for Electrochemical Sciences.
ELECTROCHEMICAL STUDIES OF REDOX SYSTEMS FOR ENERGY STORAGE Semiannual Report, 4 Dec. 1982 - 31 May 1983
Cherng-Dean Wu, Ernesto Julio Calvo, and Ernest Yeager 30 Sep. 1983 74 p refs
(Contract NAG3-219)
(NASA-CR-174503; NAS 1.26:174503; SAR-3) Avail: NTIS HC A04/MF A01 CSCL 10C

Particular attention was paid to the Cr(II)/Cr(III) redox couple in aqueous solutions in the presence of Cl(-) ions. The aim of this research has been to unravel the electrode kinetics of this redox couple and the effect of Cl(1) and electrode substrate. Gold and silver were studied as electrodes and the results show distinctive differences; this is probably due to the role Cl(-) ion may play as a mediator in the reaction and the difference in state of electrical charge on these two metals (difference in the potential of zero charge, pzc). The competition of hydrogen evolution with CrCl3 reduction on these surfaces was studied by means of the rotating ring disk electrode (RRDE). The ring downstream measures the flux of chromous ions from the disk and therefore separation of both Cr(III) and H2 generation can be achieved by analyzing ring and disk currents. The conditions for the quantitative detection of Cr(2+) at the ring electrode were established. Underpotential deposition of Pb on Ag and its effect on the electrokinetics of Cr(II)/Cr(III) reaction was studied. Author

N84-15682*# Communications Satellite Corp., Clarksburg, Md.
THIN N-I-P RADIATION RESISTANT SOLAR CELLS
Andrew Meulenberg Jul. 1983 36 p refs
(Contract NAS3-22245)
(NASA-CR-168284; NAS 1.26:168284) Avail: NTIS HC A03/MF A01 CSCL 10A

Several sets of N-I-P sola cells were fabricated from high resistivity silicon to test the effectiveness of various methods for hardening these devices against radiation. Different substrate materials were used to provide information on the effects of dopant concentration, silicon type, and the presence of oxygen. In some cells, P-type float-zone refined silicon of 800, 8000 and 15,000 omega-cm resistivity was used to provide a basis for studying resistivity and purity effects. In other cells, N-type silicon (approximately 800 omega-cm) was used to allow a comparison of dopant type. Oxygen-rich, crucible-grown, silicon (approximately 100 omega-cm, p-type) will provide information on purity effects and defect gettering. Lithium was introduced into different types of silicon to determine if mobile ions can reduce radiation induced defects in high resistivity material. Thin cells (2 mil) were fabricated to study the effects of cell thickness and carrier injection on radiation damage. The electrical characteristics of the different sets of cells were measured, analyzed, and compared prior to shipment of the cells to NASA/Lewis for irradiation. R.J.F.

N84-15683# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE SALT-GRADIENT SOLAR POND Final Scientific Report, 15 May 1982 - 14 Feb. 1983
Susan Thomas Brown Feb. 1983 112 p refs
(Grant AF-AFOSR-0201-82; AF Proj. 2301)
(AD-A126702; EOARD-TR-83-4) Avail: NTIS HC A06/MF A01 CSCL 10/1

The salt gradient solar pond was modeled both experimentally and numerically. The experimental model used a small scale tank with artificial sunlight. Both temperature and concentration measurements were taken. The numerical model used a one dimensional heat conduction model to describe the heating phenomena in the pond. The two models predicted the same type of behavior as that expected in full scale ponds. There were small differences in the two models. These differences arose from simplifications in the numerical model. Author (GRA)

N84-15684# Institute of Gas Technology, Chicago, Ill.
USAF ADVANCED TERRESTRIAL ENERGY STUDY.

VOLUME 2: TECHNOLOGY HANDBOOK Final Report, Sep. 1980 - Sep. 1982
E. J. Daniels, B. D. Yudow, and T. D. Donakowski Wright-Patterson AFB, Ohio AFWAL Apr. 1983 162 p 4 Vol.
(Contract F33615-80-C-2041; AF Proj. 3145)
(AD-A133272; AFWAL-TR-82-2019-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 10/1

This report presents the results of the USAF Advanced Terrestrial Energy Study. The objective of that study was to develop a data base of key parameters of selected energy conversion and energy storage technologies. The data base includes present and expected (through 2000) performance goals of the systems. The data base was established through an extensive literature search, surveys of manufacturers and researchers, and statistical and qualitative analyses of the available input data. The results of the study are reported in four documents: (1) Project Summary; (2) Technology Handbook; (3) Parameter Survey; (4) Analysis, Data, Bibliography. Contents (Volume II): Diesels, Gas Turbines, Stirlings, Organic Rankine Cycle, Fuel Cells, Photovoltaic Energy Conversion System, Wind Turbines, Batteries, Thermal Energy Storage System. GRA

N84-15685# Institute of Gas Technology, Chicago, Ill.
USAF ADVANCED TERRESTRIAL ENERGY STUDY. VOLUME 3: PARAMETER SURVEY Final Report, Sep. 1980 - Oct. 1982
E. J. Daniels, B. D. Yudow, and T. D. Donakowski Wright-Patterson AFB, Ohio AFWAL Apr. 1983 86 p
(Contract F33615-80-C-2041; AF Proj. 3145)
(AD-A133501; AFWAL-TR-82-2019-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 10/1

This report presents the results of the USAF Advanced Terrestrial Energy Study. The objective of that study was to develop a data base of key parameters of selected energy conversion and energy storage technologies. The data base includes present and expected (though 2000) performance goals of the systems. The data base was established through an extensive literature search, surveys of manufacturers and researchers, and statistical and qualitative analyses of the available input data. The results of the study are reported in four documents. This volume of the USAF Advanced Terrestrial Energy Study contains the estimates of specific parameters values for each technology for 1980, 1985, 1990, and 2000 at the following descrete power output levels; 1.5, 5.0, 20.0, 60.0, 100.0, 250.0, 500.0, 750.0, 1000.0, and 5000.0 kW. This parameter survey includes three major sections: one for the energy conversion technologies and two for the energy storage technologies. The output levels for the storage technologies are in terms of energy (kWh) rather than power. GRA

N84-15686# Institute of Gas Technology, Chicago, Ill.
USAF ADVANCED TERRESTRIAL ENERGY STUDY. VOLUME 4: ANALYSIS, DATA, AND BIBLIOGRAPHY Final Report, Sep. 1980 - Feb. 1982
E. J. Daniels, B. D. Yudow, and T. D. Donakowski Wright-Patterson AFB, Ohio AFWAL Apr. 1983 738 p 4 Vol.
(Contract F33615-80-C-2041; AF Proj. 3145)
(AD-A133514; 61045; AFWAL-TR-82-2019-Vol-4) Avail: NTIS HC A99/MF A01 CSCL 10/1

This report presents the results of the USAF Advanced Terrestrial Energy Study. The objective of that study was to develop a data base of key parameters of selected energy conversion and energy storage technologies. The data base includes present and expected (through 2000) performance goals of the systems. The data base was established through an extensive literature search, surveys of manufacturers and researchers, and statistical and qualitative analyses of the available input data. Final Report, Volume 4, Analysis, Data, Bibliography. GRA

N84-15687# Dame (Richard E.), Silver Spring, Md.
LINE-FOCUSING ADJUSTABLE PARABOLIC SPLAR-CONCENTRATING COLLECTOR Final Report
Richard E. Dame 30 Sep. 1983 33 p refs
(Contract FG01-81CS-15072)
(DE84-001590; DOE/CS-15072/T5) Avail: NTIS HC A03/MF A01

An Adjustable Focus Concentrating (AFC) line focus collector is described and analyzed. This device is a concentrating collector scheme which permits development of a very accurate line focus parabolic concentrating collector system by means of actively tuning a flat sheet of reflective material. The shape created by flexing this thin sheet can approximate a parabolic collector system very well. Since this is possible, the device has the potential to reduce the fabrication and assembly costs for line focus concentrating solar collectors. The purpose for the present project was to commercialize this concept. The project, therefore, was directed at evaluation of the design for potential commercialization and for fabrication. DOE

N84-15688# California Univ., Livermore. Lawrence Livermore Lab.
FLYWHEEL ENERGY-MANAGEMENT SYSTEMS FOR IMPROVING FUEL ECONOMY OF MOTOR VEHICLES Final Report
Aug. 1983 375 p refs
(Contract W-7405-eng-48)
(DE84-002340; UCRL-15562) Avail: NTIS HC A16/MF A01

The development of a second generation flywheel automobile is described. The following topics are covered: specifications, alternate prime movers, study of driveline friction, flywheel safety studies, preliminary investigation of existing automatic transmission for use with continuously variable elements, continuously variable transmission (CVT) design incorporating the Van Doorne transmatic and the Chevrolet Citation three speed automatic transmission design based on the Van Doorne transmatic and the Chevrolet Corvair power glide planetary unit, a simplified two range V-belt CVT, V-belt CVT with inverse power split, slipping clutch continuously variable transmission, hydrostatic power split studies flywheel automatic propulsion digital simulation program, real time simulation, control strategy and component sizing studies, and four square dynamometer and CVT testing. DOE

N84-15689# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
DETERMINATION OF FREEZE PROTECTION HEAT LOSS FROM A PARABOLIC TROUGH SOLAR SYSTEM
E. Kenneth May Aug. 1983 27 p refs
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)
(DE84-000005; SERI/TR-253-1906) Avail: NTIS HC A03/MF A01

Practical control temperatures for a parabolic trough, pulsed flow water freeze protection scheme was determined. Heat loss from stagnant water in the absorber tube under freezing ambient conditions was measured. Manipulation of long term weather data provides estimates of annual thermal losses to prevent freezing. In a cold climate such as Denver, Colorado's, which typically has 155 freezing days per year, such losses should be less than 0.7% of the annual energy delivered by an efficient parabolic trough system. DOE

N84-15690# Helionetics, Inc., San Diego, Calif. Laser Processing Lab.
BEAM PROCESSING FOR HIGH-EFFICIENCY SI SOLAR CELLS
G. A. vanderLeeden, R. T. Young, R. L. Sandstrom, R. F. Wood (ORNL), and R. D. Westbrook (ORNL) 1983 6 p refs
(DE84-002059; CONF-831028-4) Avail: NTIS HC A02/MF A01

High-efficiency silicon solar cells have been made using two different techniques for dopant implantation and two types of lasers for annealing of the implantation damage. Regardless of the type of lasers used for the annealing, a 1-KeV glow discharge BF3 implantation gave higher-efficiency solar cells than conventional mass-analyzed 5 kV (11)B implantation. The implanted layers were annealed with XeCl excimer and ruby lasers. Excimer laser annealing was found to give superior results. Spectral-response measurements showed that the higher efficiencies were the result of an improved blue response. The use of glow discharge BF3 implantation and excimer laser annealing resulted in P( )n

cells with AM1 efficiencies greater than 16.5%, as measured at the Solar Energy Research Institute. DOE

N84-15691# Midwest Research Inst., Golden, Colo. Solar Research Inst.
PROGRESS IN POLYCRYSTALLINE THIN-FILM SOLAR CELLS
K. Zweibel, A. Hermann, and R. L. Mitchell Jul. 1983 6 p refs Presented at Solar World Congr., Perth, Australia, 15 Aug. 1983
(Contract DE-AC02-77CH-00178)
(DE83-012131; SERI/TP-211-2048; CONF-830839-2) Avail: NTIS HC A02/MF A01

Photovoltaic devices based on several polycrystalline thin-film materials have reached near and above 10% sunlight-to-electricity conversion efficiencies. This paper examines the various polycrystalline thin-film PV materials including CuInSe2 and CdTe in terms of their material properties, fabrication techniques, problems, and potentials. DOE

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N84-15692# Defense Nuclear Agency, Washington, D.C. Office of Operational Safety.
SUMMARY OF ANNUAL ENVIRONMENTAL REPORTS FOR CY 1981: DEPARTMENT OF ENERGY NUCLEAR SITES
Dec. 1982 54 p refs
(DOE/EP-0038/1) Avail: NTIS HC A04/MF A01

During CY 1981, radiation exposures to off-site populations from Department of Energy (DOE) nuclear facilities were well within regulatory limits. The maximum reported individual whole body dose to any member of the public from any DOE site was 15 mrem for the year. This can be compared to the 130 mrem average background exposure received each year by an individual living in the United States (EPA 1977). The total population dose received by individuals living within an 80-km (50-mi) radius of these sites was 230 man-rem from DOE operations, compared to a total of nearly eight million man-rem to the same populations from natural sources. Nonradiological releases in site effluents were generally within prescribed regulatory limits, with several facilities having pollution abatement projects planned or under construction to correct noncompliance conditions. Inadvertent releases of radioactive and nonradioactive pollutants had no significant health or ecological impacts. Author

N84-15693# Oak Ridge National Lab., Tenn. Health and Safety Research Div.
METHODOLOGY FOR THE OBJECTIVE VALIDATION OF MODEL PERFORMANCE, WITH AN APPLICATION TO ATMOSPHERIC TRANSPORT MODELS
D. E. Fields, C. W. Miller, S. E. Kurtz, and S. J. Cotter 1983 10 p refs Presented at the Summer Computer Simulation Conf., Vancouver, Canada, 11 Jul. 1983
(Contract W-7405-eng-26)
(DE83-015693; CONF-830707-6) Avail: NTIS HC A02/MF A01

The TERPED computer code was used to perform Kolmogorov-Smirnov and graphical analyses of normalized crosswind integrated ground-level air concentration measurements of zinc sulfide particles released from a height of 111 m at Hanford, Washington as reported by Nickola. It is demonstrated that the data may be considered to be distributed log-normally ((-) - 0.014), but not normally ((-) = 0.86). Simulations of particulate transport used each of three methods of stability determination: (1) vertical temperature gradient; (2) standard deviation of wind direction; and (3) vertical temperature gradient and wind speed, and each of five dispersion parameterizations. Model performance was evaluated by computing the root mean squared difference of log transformed value pairs, and it is shown that method (2) and Julich (100m) dispersion values gave the best results. DOE

N84-15694# Department of Energy, Albuquerque, N. Mex.
STATUS OF RESEARCH IN PROGRESS AT THE INHALATION TOXICOLOGY RESEARCH INSTITUTE [] Annual Report, 1 Oct 1981 - 30 Sep. 1982
M. B. Snipes, ed., T. C. Marshall, ed., and B. S. Martinez, ed. Dec. 1982 589 p refs
(Contract DE-AC04-76EV-01013)
(DE83-012610; LMF-102) Avail: NTIS HC A25/MF A01

The effect on man of airborne particulates and gaseous emissions associated with the production of energy was studied. The following papers are included: (1) the physical and chemical characterization of energy technology aerosols; (2) laboratory studies of aerosol generation and characterization; (3) in vitro predictors of toxicity; (4) disposition and fate of inhaled materials; (5) dose response relationships for inhaled radionuclides; (6) does response relationships for inhaled chemical toxicants; (7) biological factors which influence dose response relationships; and (8) risk assessment. DOE

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N84-15695 Pennsylvania State Univ., University Park.
A DIAGNOSTIC CASE STUDY OF THE EFFECTS OF DEEP EXTRATROPICAL CONVECTION ON THE LARGE-SCALE TEMPERATURE AND MOISTURE STRUCTURE Ph.D. Thesis
Ying-Hwa Kuo 1983 245 p
Avail: Univ. Microfilms Order No. DA8320897

Heat and moisture budgets are analyzed in a case (10-11 April, 1979) observed in SESAME 79 to diagnose the effects of organized midlatitude convection on its environment. The major findings are (1) the heating distribution of midlatitude cumulus convection does not have a significant variation on scales greater than 550 km x 550 km and periods longer than 6 h. Despite strong differences in midlatitude and tropical convection, the vertical heating distribution of midlatitude organized convection is similar to that obtained in the tropics for a much longer temporal scale and larger spatial scales; (2) the convective rainfall rate is closely related to vertical moisture advection and total horizontal moisture convergence, suggesting that it is possible to parameterize midlatitude organized convection in large scale numerical models; (3) when a steady state cloud model is used to simulate cloud thermodynamic properties with a small cloud radius, both Kuo's and Anthes's schemes simulate a level of maximum heating much lower than is observed. Both schemes are improved when a larger cloud radius is used. Dissert. Abstr.

N84-15696 Southern Methodist Univ., Dallas, Tex.
THEORETICAL AND EMPIRICAL TERRESTRIAL HEAT FLOW STUDIES Ph.D. Thesis
John Peter Ziagos 1983 156 p
Avail: Univ. Microfilms Order No. DA8320672

Twenty new heat flow measurements in southern Mexico are presented. These measurements document a very broad zone of low heat flow between the coastline and the Trans-Mexico volcanic belt. At the Trans-Mexico volcanic belt, heat flow increases to high values and remains high into central Mexico. Heat flow values in the Trans-Mexico volcanic belt and northward are in excess of 80 mWm-(2)(1.9 cal/sq cm sec) and typical of values observed in the high heat flow regions of the western United States. A surface heat flow profile was constructed perpendicular to the trench and the data were matched with a simple thermal subduction model. The resulting final model parameter set suggests that the angle of subduction is low and that there is convective heat transfer in the back arc region. Because the subduction zone lies under a continental region it is possible to calculate reduced heat flow values. Dissert. Abstr.

N84-15697 California Inst. of Tech., Pasadena.
INTERPRETATION OF NEAR-SOURCE GROUND MOTION AND IMPLICATIONS Ph.D. Thesis
Hsiu-Lin Liu 1983 198 p
Avail: Univ. Microfilms Order No. DA8321025

This thesis presents some deterministic modeling and interepretation of various aspects of observed near source ground motions. In Chapter 1, finite source parameters determined from waveform modeling studies are presented for two California earthquakes; the 1979 Coyote Lake event and the 1966 Parkfield event. These events were recorded by strong motion arrays with similar station to fault rupture geometries. Thus it is possible to demonstrate that differences in the ground motions recorded within 30 km of the epicenter are indeed due to the differences in rupture fault length and dislocation distribution. Details of the waveform modeling for the August 6, 1979 Coyote Lake earthquake are described in part 1-A. In Chapter 2, high frequency ground motions (ground velocity and acceleration) recorded at less than 30 km epicentral distances are studied for two aftershocks of the 1979 Imperial Valley, California earthquake. In Chapter 3, the ground motion data from the 1971 San Fernando earthquake recorded at epicentral distances of less than 100 km are presented.
Dissert. Abstr.

N84-15698 Stanford Univ., Calif.
WAVE PROPAGATION IN POROUS ROCK AND MODELS FOR CRUSTAL STRUCTURE Ph.D. Thesis
Terry Dean Jones 1983 231 p
Avail: Univ. Microfilms Order No. DA8320729

The physics of wave propagation and attenuation in porous rock is a critical input to crustal exploration seismology. New experimental results are reported on velocity and attenuation in wet sandstone at elevated temperature and pressure. Both velocity and attenuation decrease with increasing temperature at all pressures. This proves that thermal relaxation is not operating under these conditions. Rather dissipation is controlled by a viscous fluid flow mechanism, in which a sharp frequency peak in attenuation is shifted from 2 kHz at room temperature to 8 kHz at 120 C as the pore fluid viscosity is decreased with increasing temperature. The frequency dependence is not spread or suppressed with increased pressure, but the modulus defect is decreased. A greater knowledge of Q in crustal rocks has aided interpretation of deep seismic reflection profiles of the Wind River Mountains, Wyoming. Numerous reflections at long travel times are controversial because of the possible presence of multiples from the shallow sedimentary section. Dissert. Abstr.

N84-15699 Stanford Univ., Calif.
DIP-MOVEOUT BY FOURIER TRANSFORM Ph.D. Thesis
Ira David Hale 1983 94 p
Avail: Univ. Microfilms Order No. DA8320716

The conventional normal-movement (NMO) and common midpoint (CMP) stacking process enhances reflections having a particular movement velocity, while attenuating events (such as multiple reflections) having different moveout velocities. Unfortunately, this process also acts as a dip filter applied to the CMP stack. In other words, NMO and stacking enhances reflections having a particular slope in the CMP stack, while attenuating reflections having different slopes. NMO and stacking, like any dip filter, degrades lateral esolution. Fortunately, this dip-filtering action can be suppressed by applying, in addition to NMO, a prestack process known as DEVILISH, prestack partial migration, and dip-movement. As the latter term implies, this process is a dip-dependent moveout correction that enables reflections from both horizontal and dipping reflectors to be stacked with the same NMO velocity. Stated another way, NMO velocities estimated from dip-moveout-corrected seismograms are independent of the dips of subsurface reflectors. Dissert. Abstr.

N84-15700 California Inst. of Tech., Pasadena.
CONSTRAINTS ON THE EARTH'S ANELASTIC AND ASPHERICAL STRUCTURE FROM ANTIPODAL SURFACE WAVES Ph.D. Thesis
Eric Paul Chael 1983 147 p
Avail: Univ. Microfilms Order No. DA8321011

Seismograms recorded at antipodal distances (delta approx. 180 deg) are used to measure the attenuation and dispersion of surface waves. The antipode is a focus for surface wave energy radiated at all directions from the source. Antipodal records thus give direct estimates of global average properties. Laterally heterogeneous Earth structure degrades the focusing and complicates the data analysis. Group velocity and Q of 120-300 s Rayleigh waves are obtained from a record (station PTO) of the May 23, 1968 New Zealand earthquake. The effects of aspherical structure on this record are simulated by generating synthetic seismograms for an ellipsoidal Earth. The results show that the bias in antipodal Q measurements varies with time. This property is used to constrain the bias in the PTO measurements. A seismogram of the August 19, 1977 Indonesian earthquake from station TRN is used to study 250-500 s Rayleigh waves. Dissert. Abstr.

N84-15701 State Univ. of New York, Albany.
CLEAR ATMOSPHERIC EFFECTS ON INSOLATION ILLUSTRATED BY BROAD-BAND RADIOMETER MEASUREMENTS Ph.D. Thesis
Daniel William Spencer 1983 167 p
Avail: Univ. Microfilms Order No. DA8322620

Spectral measurements from the Solar Energy Meteorological Research and Training Site Region II monitoring station are used to determine some of the effects of the cloudless atmosphere on the surface insolation. The effects illustrated are aerosol scattering and absorption, attenuation by volcanic dust clouds, and water vapor absorption. Parameters determined from the measurements are also compared to the results from a radiative transfer model. The direct and global solar infrared spectrum decreases with increasing dew point. A linear regression between dew point and the direct and global intensities under clear skies resulted in predictive errors less than 10 per cent. The visible portions of the spectrum were not effected. The measured aerosol optical depths were compared to the results of a radiative transfer model. The diffuse-to-direct ratio increased with increasing optical depth in a similar fashion in both the radiative transfer model and measurements. Dissert. Abstr.

N84-15702 California Inst. of Tech., Pasadena.
THERMAL TIDES IN THE ATMOSPHERE OF VENUS Ph.D. Thesis
Judith Burt Pechmann 1983 294 p
Avail: Univ. Microfilms Order No. DA8321031

The daily variation in the absorption of sunlight by the atmosphere is the forcing for thermal tides. In this thesis the response of the Venus atmosphere as a function of height and latitude to the diurnal and semidiurnal components of the forcing is calculated using a linearized primitive equation model. The atmospheric mean state is specified using data from the Pioneer Venus probes and orbiter. The model results agree with the solar fixed component of the brightness temperature fluctuations determined from Pioneer Venus orbiter infrared radiometer (OIR) data. Contrary to the prediction of classical tidal theory, the observed semidiurnal brightness temperature maxima occur before the forcing maxima from about 50 to 80 km. In the model, this phase lead is due to a long vertical wavelength (approx. 30 km) from the cloud tops to 80 km. Also, the data unexpectedly show that the semidiurnal amplitude is larger than the diurnal over much of the region observed, even though the diurnal forcing is about twice as great. The model's diurnal temperature amplitude is larger than that observed in the brightness temperature.
Dissert. Abstr.

N84-15703 Michigan Univ., Ann Arbor.
VACUUM ULTRAVIOLET PHOTOFRAGMENTATION OF H2O AND NO2: LABORATORY STUDIES AND ATMOSPHERIC APPLICATIONS Ph.D. Thesis
Jan-Bai Nee 1983 170 p
Avail: Univ. Microfilms Order No. DA8324253

Vacuum ultraviolet photodissociation of H2O and NO2 in a

flow system is discussed with emphasis on the electronic energy deposited in the fragments. Quantum yields for producing the excited OH(A2 sigma+), NO(A(2) sigma +) and NO(B(2) pi) systems were measured at wavelengths 1216, 1236, 1302 A by observing the photofragmentation fluorescence of the electronic transitions from these excited states to the ground state. Moreover, quenching and pressure induced transitions between different excited states were studied for NO; results were found to be consistent with theoretical prediction. Quantum yields are generally low with values less than 10%. These laboratory investigations in the Earth's stratosphere are most important. Since water vapor generates the most important hydrogen radical, OH, in the stratosphere, the accurate measurement of water is of significant value. Dissert. Abstr.

N84-15704 Harvard Univ., Cambridge, Mass.
BAROCLINIC INSTABILITY OF ATMOSPHERIC JETS Ph.D. Thesis
Petros John Ioannou 1983 181 p
Avail: Univ. Microfilms Order No. DA8322373

The pioneering baroclinic instability studies of Charney (1947) and Eady (1949) have been extended to include the effects of a meridional shear in the zonal wind. A linear perturbation theory has been developed to determine the spectral characteristics (growth rates and phase speeds), the meridional and vertical structures of the unstable waves, as well as the initial acceleration of the mean zonal flow. The analysis shows that as the jet broadens the spectrum of unstable waves in fact asymptotes to that for a meridionally uniform flow, as in the classical Charney and Eady problems. The inclusion of a meridional jet in the Charney problem leads to complex meridional wavenumbers for the unstable modes. The unstable waves have been found to decrease exponentially away from the center of the jet; this is consistent with the observation that the storm tracks always follow the jet stream. The effect of the unstable waves on the mean flow is to reduce the vertical shear while sharpening the meridional curvature of the jet. Dissert. Abstr.

N84-15705 Harvard Univ., Cambridge, Mass.
THE CAUSATION AND VARIABILITY OF THE NORTHERN WINTER QUASI-STATIONARY PLANETARY WAVES Ph.D. Thesis
David Alan Jacomin 1983 196 p
Avail: Univ. Microfilms Order No. DA8322377

This thesis investigates the causation and sensitivity of the Northern Hemisphere winter quasi-stationary planetary waves. The model used is a linearization about observed zonal wind and temperature fields. The linearized primitive equations are solved separately for each wavenumber on a fine (1.5 deg horizontal by 1 kilometer vertical) grid. The model's lid is placed high enough so that spurious energy reflections are made negligible. Realistic topography and heating are used to force the model. Some idealized heatings are also studied. It is found that the model produces an acceptably realistic response. The chief causation of this response is topographic forcing. The interannual variability of the waves is found to be explained by (a) the variation of the topographic response due to changes in the zonal state and to a lesser extent, by (b) the variability of the heating field. However, the sensitivity of the response is found to be too small to explain the causation of large amplitude persistent anomalies.
Dissert. Abstr.

N84-15706*# Colorado Univ., Boulder. Dept. of Astrogeophysics.
ALTERNATIVE EXPERIMENTS USING THE GEOPHYSICAL FLUID FLOW CELL Final Report
John E. Hart Washington NASA Jan. 1984 47 p refs
(Contract NAS8-31958)
(NASA-CR-3766; NAS 1.26:3766) Avail: NTIS HC A03/MF A01 CSCL 04A

This study addresses the possibility of doing large scale dynamics experiments using the Geophysical Fluid Flow Cell. In particular, cases where the forcing generates a statically stable stratification almost everywhere in the spherical shell are evaluated. This situation is typical of the Earth's atmosphere and oceans. By calculating the strongest meridional circulation expected in the spacelab experiments, and testing its stability using quasi-geostrophic stability theory, it is shown that strongly nonlinear baroclinic waves on a zonally symmetric modified thermal wind will not occur. The Geophysical Fluid Flow Cell does not have a deep enough fluid layer to permit useful studies of large scale planetary wave processes arising from instability. It is argued, however, that by introducing suitable meridional barriers, a significant contribution to the understanding of the oceanic thermocline problem could be made. Author

N84-15707# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
ON THE FUNCTIONAL DEPENDENCE OF THE FREEZING POINT OF SOILS ON THE COMPOSITION OF WATER SOLUBLE SALTS IN AN INTERSTITIAL SOLUTION
Yu. Ya. Velli and P. A. Grishin 1983 9 p Transl. into ENGLISH from the book "Rheology of Soils and Engineering Geocryology" USSR, 1982 p 193-196
(NRC/CNR-TT-2070; ISSN-0077-5606; Ser-248) Avail: NTIS HC A02/MF A01

The fundamental factors influencing the temperature at the freezing point of saline soils were determined. The freezing point of soils is the boundary of change of physical state; the transition is from thawed to frozen state and is the beginning of the phase transitions of the interstitial solution. The freezing point is dependent on many factors especially in the case of saline soils, the quantitative and qualitative composition of readily soluble salts and is determined by experimental means. Experiments were conducted with soils from the Arctic coast which were of differing granulometric composition which differ in minerals and salt composition. The soils were of marine origin. E.A.K.

N84-15708*# Purdue Univ., Lafayette, Ind. Dept. of Geoscience.
SEISMIC PROPERTIES OF THE CRUST AND UPPERMOST MANTLE OF NORTH AMERICA Final Technical Report
L. W. Braile, W. J. Hinze, R. R. B. vonFrese, and G. R. Keller 15 Aug. 1983 48 p refs Sponsored in part by LASL
(Grants NCC5-21; NAS5-25030)
(NASA-CR-175134; NAS 1.15:175134) Avail: NTIS HC A03/MF A01 CSCL 08G

Seismic refraction profiles for the North American continent were compiled. The crustal models compiled data on the upper mantle seismic velocity (P sub n), the crustal thickness (H sub c) and the average seismic velocity of the crystalline crust (V sub p). Compressional wave parameters were compared with shear wave data derived from surface wave dispersion models and indicate an average value for Poisson's ratio of 0.252 for the crust and of 0.273 for the uppermost mantle. Contour maps illustrate lateral variations in crustal thickness, upper mantle velocity and average seismic velocity of the crystalline crust. The distribution of seismic parameters are compared with a smoothed free air anomaly map of North America and indicate that a complidated mechanism of isostatic compensation exists for the North American continent. Several features on the seismic contour maps also correlate with regional magnetic anomalies. E.A.K.

N84-15709*# National Aeronautics and Space Administration, Washington, D. C.
NONUNIFORMITY OF THE EARTH'S ROTATION AND THE MOTION OF THE POLES
N. S. Sidorenkov Jul. 1983 24 p Transl. into ENGLISH from Priroda (USSR), no. 4, 1982 p 82-91 Original language document was announced as A82-31650 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77337; NAS 1.15:77337) Avail: NTIS HC A02/MF A01 CSCL 08G

The study of the nonuniformity of the Earth's rotation and the motion of the poles has great practical and theoretical significance.

This study makes it possible to determine the coordinates of celestial and terrestrial objects, and to gain information in many domains of earth science. This paper reviews studies of rotation nonuniformity and polar motion, giving attention to astronomical data; the nature of periodic oscillations of the Earth's rotation; the nature of long-period variations of the Earth's rotation rate; and the use of Earth-rotation data in hydrometeorology. B.J.

N84-15710*# California Inst. of Tech., Pasadena. Seismological Lab.
LATERAL HETEROGENEITY AND AZIMUTHAL ANISTROPY OF THE UPPER MANTLE: LOVE AND RAYLEIGH WAVES 100-250 SEC Interim Report
Toshiro Tanimoto and Don L. Anderson [1983] 35 p refs
(Grant NsG-7610)
(NASA-CR-174619; NAS 1.26:174619) Avail: NTIS HC A03/MF A01 CSCL 08G

The lateral heterogeneity and apparent anisotropy of the upper mantle are studied by measuring Rayleigh and Love wave phase velocities in the period range 100-250 sec. Spherical harmonic descriptions of the lateral heterogeneity are obtained for order and degree up to 1=m=10. Slow regions are evident at the East Pacific rise, northeast Africa, Tibet, Tasman sea, southwestern North America and triple junctions in the Northern Atlantic and Indian oceans. Fast regions occur in Australia, western Pacific and the eastern Atlantic. Details which are not evident in previous studies include two fast regions in the central Pacific and the subduction zone in the Scotia Arc region. Inversion for azimuthal dependence showed (1) little correlation between the fast phase velocity directions and the plate motion vector in plate interiors, but (2) correlation of the fast direction with the perpendicular direction to trenches and ridges. Phase velocity is high when waves propagate perpendicular to these structures. Severe tradeoffs exist between heterogeneity and azimuthal dependence because of the yet unsatisfactory path coverage. Author

N84-15711*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DATA ANALYSIS AND THEORETICAL STUDIES FOR ATMOSPHERIC EXPLORER C, D AND E Final Report, 9 Jun. 1971 - 31 May 1983
A. Dalgarno Aug. 1983 7 p
(Contract NAS5-11437)
(NASA-CR-175121; NAS 1.26:175121) Avail: NTIS HC A02/MF A01 CSCL 04A

The research concentrated on construction of a comprehensive model of the chemistry of the ionosphere. It proceeded by comparing detailed predictions of the atmospheric parameters observed by the instrumentation on board the Atmospheric Explorer Satellites with the measured values and modifying the chemistry to bring about consistency. Full account was taken of laboratory measurements of the processes identified as important. The research programs were made available to the AE team members. Regularly updated tables of recommended values of photoionization cross sections and electron impact excitation and ionization cross sections were provided. The research did indeed lead to a chemistry model in which the main pathways are quantitatively secure. The accuracy was sufficient that remaining differences are small. B.W.

N84-15712# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Seismology.
EFFECTIVE USE OF EARTHQUAKE DATA
Thomas V. McEvilly, C. Allin Cornell, Ricardo Dobry, Robert B. Herrmann, and Hiroo Kanamori 1983 65 p
(Contract N00014-82-G-0016)
(AD-A134077) Avail: NTIS HC A04/MF A01 CSCL 08/11

The panel on Data Problems in Seismology was established by the Committee on seismology to review seismic data problems and to make recommendations. The results of the panel's findings presented in this report focus on seismological data from earthquakes. Estimates are given of personal and future digital data quantities. Reports are presented on panel member's organizational seismological studies and applications. B.W.

N84-15713# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.
THE NORWEGIAN SEISMIC ARRAY (NORSAR). PHASE 3 Semiannual Technical Summary Report, 1 Oct. 1982 - 31 Mar. 1983
Linda B. Tronrud Jun. 1983 93 p
(Contract F08606-79-C-0001; ARPA Order 2551)
(AD-A134038; NORSAR-SCIENTIFIC-2-82/83; NORSAR-CONTRIB-334) Avail: NTIS HC A05/MF A01 CSCL 08/11

This report describes the operation, maintenance and research activities at the Norwegian seismic array (NORSAR) for the period 1 October, 1982 to 31 March, 1983. B.W.

N84-15714# Systems Science and Software, La Jolla, Calif.
SURFACE WAVE PATH CORRECTIONS, DETERMINISTIC DISCRIMINATION AND BODY WAVE ATTENUATION Semiannual Technical Report
W. E. Farrell, J. L. Stevens, John M. Savino, B. Snkoller, and L. B. Bache Oct. 1982 180 p
(Contract F08606-80-C-0016; ARPA Order 2551; ARPA Order 4406; ARPA Order 4435)
(AD-A133574; SSS-R-83-5776; VSC-TR-83-12) Avail: NTIS HC A09/MF A01 CSCL 08/11

Rayleigh waves from the Eastern Kazakh test site recorded at Seismic research Observatory receivers have been analysed for phase-velocity dispersion, group velocity dispersion and spectral amplitude. Linear inversion theory has been used to interpret these data as arising from waves propagating in plane-layered earth models. This yields the mean shear velocity and attenuation over each path as well as the moment of the source. Using the path models, synthetic seismograms have been calculated for use in more refined estimated of source type and source strength. Multivariate linear discrimination has been used to distinguish synthetic body wave spectra of explosions from synthetic body wave spectra of earthquakes. The same algorithm with no modification is highly successful at distinguishing the body wave spectra for real events. High frequency attenuation of the spectra fro real data causes the deterministic discriminant to be biased. It is shown how the bias is used to infer t^* (seismic attenuation). The attenuation parameter, t^*, has been calculated for Kazakh-SRO and NTS-SRO paths for several score underground explosions. For NTS sources, t^* is about 0.8. For Kazakh sources t^* ranges between 0.2 and 0.8. GRA

N84-15715# Battelle Inst., Frankfurt am Main (West Germany).
DEVELOPMENT OF GENERIC MOBILITY-TERRAIN DATA BASES: INVESTIGATION OF CRITICAL SOIL PARAMETERS Interim Technical Report, Apr. - Aug. 1983
Peter Jessl and Werner Koeppel Aug. 1983 3 p
(Contract DAJA45-82-C-0004)
(AD-A133595) Avail: NTIS HC A02/MF A01 CSCL 08/13

For two regions in West Germany - which resulted from the WES topographic and climatic terrain regionalization - extensive ground truth testing was performed in order to evaluate the relative degrees of similarity of two or more terrain patches with respect to ground mobility conditions. Within the regions investigated for the generic modeling about 30 sites were selected within potentially wet areas for CH, CL, MH, ML and organic soil sites. Selection was based on 1:25,000 scale soil maps, 1:200,000 soil site condition maps as well as site visits. GRA

N84-15716# California Univ., Berkeley.
STATE-OF-THE-ART FOR ASSESSING EARTHQUAKE HAZARDS IN THE UNITED STATES. REPORT 20: THE CONTRIBUTION OF DIRECTIVITY FOCUSING TO EARTHQUAKE INTENSITIES
Bruce A. Bolt Aug. 1983 98 p
(Contract DACW39-82-M-1125)
(AD-A132893; WES-MP-S-73-1-20) Avail: NTIS HC A05/MF A01 CSCL 08/11

This report describes available evidence for effects of moving sources in earthquakes and analyzes them in terms of the physics

of wave emission. The study is addressed mainly to questions arising in geotechnical investigations for engineering purposes and suggestions are made on the significance of the effect in strong ground motion estimation. From a seismological point of view, the effect of the moving source has been clearly demonstrated in numerous studies using seismographs located at both moderate and great distances (i.e., the far field) from the source. Such studies, however, usually concern long-period seismic waves with periods above 2 to 5 seconds. Second, when seismic waves in the near field with a range of wave frequencies characteristic of engineered structures (i.e., 1 Hz to 10 Hz) are considered, there is as yet only limited definitive evidence available, and this is somewhat contradictory. Nevertheless, the likelihood is that the elementary predictions of the magnitude of the effects can be sometimes modified by other features of the source mechanism, the geological variations along the wave paths and within the fault zone. Third, the ratio of peak horizontal ground motion in the forward direction of fault rupture to the peak motion in the backwards direction is probably greatest for ground displacements and velocities and least for peak accelerations. High frequency ground accelerations show variations due to scattering, attenuation, and source asperities that mask directivity effects. GRA

N84-15717# Sandia Labs., Albuquerque, N. Mex.
MICROCRACK DAMAGE MODEL OF BRITTLE ROCK
Laurence S. Costin Oct. 1983 45 p refs
(Contract DE-AC04-76DP-00789)
(DE84-002088; SAND-83-1590) Avail: NTIS HC A03/MF A01

Improvements of a proposed model which describes stress and time dependent microcrack growth in brittle rock are discussed. The model is extended to a fully three dimensional description of damage nucleation and growth a vectorial description of the damage induced by microcrack growth is proposed and several improvements in the description of crack growth on the microscale are discussed. The improvements lead to a development of damage surfaces (surfaces of constant damage in stress space). A failure criterion for brittle rock based on the concept of critical damage is proposed. Several examples of model calculations under a variety of stress states and histories are presented. DOE

N84-15718# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
NUMERICAL SIMULATIONS OF CONVECTIVELY EXCITED GRAVITY WAVES
Gary A. Glatzmaier 1983 11 p refs Presented at the Solar Seismology from Space Conf., Snowmass, Colo., 17-19 Sep. 1983
(Contract W-7405-eng-36)
(DE84-001867; LA-UR-83-2896; CONF-8308136-1) Avail: NTIS HC A02/MF A01

Magnetoconvection and gravity waves were numerically simulated with a nonlinear, three dimensional, time dependent model of a stratified, rotating, spherical fluid shell heated from below. A Solar like reference state is specified while global velocity, magnetic field, and thermodynamic perturbations are computed from the anelastic magnetohydrodynamic equations. Convective overshooting from the upper (superadiabatic) part of the shell excites gravity waves in the lower (subadiabatic) part. Due to differential rotation and Coriolis forces, convective cell patterns propagate eastward with a latitudinally dependent phase velocity. The structure of the excited wave motions in the stable region is more time dependent than that of the convective motions above. The magnetic field tends to be concentrated over giant cell downdrafts in the convective zone but is affected very little by the wave motion in the stable region. DOE

N84-15719# Los Alamos Scientific Lab., N. Mex. Earth and Space Sciences Div.
MICROINSTABILITIES IN THE HIGH LATITUDE F REGION: A BRIEF REVIEW
S. Peter Gary 1983 32 p refs Presented at the DNA Hilat/Late Time Meeting, Palo Alto, Calif., 5-8 Oct. 1983
(Contract W-7405-eng-36)
(DE84-001709; LA-UR-83-2997; CONF-8310204-1) Avail: NTIS HC A03/MF A01

The theory of plasma microinstabilities that may arise in the high latitude F region ionosphere below 1000 km was reviewed. Three free energy sources are considered: a density gradient perpendicular to the ambient magnetic field-B, a current parallel to B and a steady electric field perpendicular to B. The BGK model for charged neutral collisions is used, and the short wavelength properties of the universal density drift, current convective and E x B gradient drift instabilities are compared. At sufficiently high altitudes and sufficiently steep gradients, the universal instability is the short wavelength mode most likely to grow and, through wave particle diffusion, to cause relatively steep wavenumber dependences in power spectra. DOE

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N84-15720 Wisconsin Univ., Madison.
A COMPARISON OF NMC MODELS (1977) ON PRECIPITATION FORECASTS FOR EAST COAST CYCLOGENESIS Ph.D. Thesis
Alan Nierow 1983 343 p
Avail: Univ. Microfilms Order No. DA8317040

The 9 Layer Global (9LGLB), 7 Layer Primitive Equation (7LPE) and Limited Fine Mesh (LFM) models are evaluated with respect to their accuracy in predicting precipitation associated with two east coast winter storms. Various forecast model fields are examined in order to determine the causes for model errors. The models' 700 mb postprocessed vertical motion fields are compared to the vertical motion fields calculated from Quasi-Geostrophic theory. The LFM is initialized with different analysis schemes in order to determine what effect this has on rainfall forecasts. A new convective algorithm is introduced into the LFM in order to emulate more realistically the convective precipitation from the real atmosphere. The results from this study reveal that in comparison with the 9LGLB model, both the 7LPE and especially the LFM are more accurate with their respective precipitation forecasts. The model's postprocessed vertical motion field is significantly different in comparison to the vertical motion field calculated from QG theory. Dissert. Abstr.

N84-15721 Wisconsin Univ., Madison.
POSSIBLE TIDAL MODULATION OF THE INDIAN MONSOON ONSET Ph.D. Thesis
William Henry Campbell 1983 158 p
Avail: Univ. Microfilms Order No. DA8316201

The a priori hypothesis that soli-lunar atmospheric tides can induce an element of the variability in mean monthly climatic data is tested using precipitation (1895-1960), station pressure (1895-1960) and 300 mb height data (1950-1977) for india during the monsoon onset month of June. Since the monsoon onset occurs, on average, very late in the month in northern India, this region is very sensitive to small departures from normal in the onset date. These departures can be seen in the year to year fluctuations of June rainfall amounts. To test the hypothesis involvng lunar atmospheric tides, a time series of man monthly lunar tidal potential for June (1895-1960) was calculated. A periodogram of this time series is dominated by two frequencies, .0537 year-1 and .263 year(-) which explain almost 100 percent of the variance. The frequency spectrum of the first eigenvector of June precipitation is dominated by these two frequencies with the frequency .0537 year(-1) being shifted somewhat lower. This frequency shift was caused by a nonlinerity in the atmospheric response to the forcing. Dissert. Abstr.

N84-15722 Pennsylvania State Univ., University Park.
OCEAN TEMPERATURE CHANGES INDUCED BY TROPICAL CYCLONES Ph.D. Thesis
Peter Gerard Black 1983 311 p

Avail: Univ. Microfilms Order No. DA8320865

Sea surface temperature (SST) decreases and mixed layer depth (MLD) increases occur in crescent-shaped patterns with respect to the moving storm center. The largest SST decreases occur in the right-rear quadrant of the storm at an average distance of 1.5 times the radium of maximum wind (RMAX). Storms moving slower than 3 m/s produce SST decreases of 3-5 C within one-half day of storm passage while faster moving storms produce only 1-3 C decreases. The observations suggest that SST decreases continue at a location to the right of the storm track became larger for a period of 0.6 to 1.4 days after the storm forcing has moved away. A residual vertical circulation appears to be sustained for some time after storm passage which continues to transport colder water upward beneath the storm track and warmer water downward beyond two times RMAX to the right of the track. Following the initial response, the residual SST and MLD patterns are modulated by an internal, inertia-gravity wave response. Dissert. Abstr.

N84-15723 Pennsylvania State Univ., University Park.
SOME EFFECTS OF SURFACE HEATING AND TOPOGRAPHY ON THE REGIONAL SEVERE STORM ENVIRONMENT Ph.D. Thesis
Stanley George Benjamin 1983 292 p
Avail: Univ. Microfilms Order No. DA8320864

A combined synoptic and numerical investigation demonstrates several effects of surface heating and topography on the evolution of the regional scale severe storm environment. A hypothesized elevated mixed layer effect, summarized in a conceptual model, is found downstream of the Mexican plateau both in observations and in three dimensional modeling simulations of two cases of the 1979 SESAME field program, 10-11 April and 9-10 May. In both of these cases, the occurrence of thunderstorms was prevented over a large area where a strong elevated mixed layer restraining inversion (or 'lid') was present. Deep convective storms were instead focused in the region where a southeasterly low level current flowed under a sharp northern and western boundary of the strong capping inversion. While the low level flow has been generally thought of as a source of moisture for severe thunderstorms, it is shown that differential advection becomes particularly important as a process of static destabilization when the low level flow beneath the lid edge possesses a large ageostrophic component. Dissert. Abstr.

N84-15724 Illinois Univ., Urbana-Champaign.
MIDDLE LATITUDE FORCING OF A MODEL TROPICAL ATMOSPHERE WITH HORIZONTALLY NONUNIFORM BASIC STATES Ph.D. Thesis
Jeffrey David Wilson 1983 184 p
Avail: Univ. Microfilms Order No. DA8324674

A model of the tropical atmosphere, based on the primitive equations with beta-plane geometry and a latitudinally and longitudinally varying basic state is used to simulate the response of the tropics to middle latitude forcing. The equations of motion are linearized about a seasonally dependent basic state flow corresponding to the observed wind field in the upper troposphere. The dynamical steady state responses of the model atmosphere to planetary wave modes, each with a prescribed azimuthal wavenumber, meridional wavenumber, equivalent depth, and period at a middle latitude boundary are determined. The quasi-linear interactions between a forcing mode and the longitudinally varying part of the basic state flow give rise to a family of tropical modes with azimuthal wavenumbers different from that of the forcing. The behavior of each mode is governed by its refractive index which depends on the parameters of the wave mode and the basic state. It is shown that under certain parametric conditions the refractive index associated with a non-forcing mode can be such that a quasi-resonant response is possible. Dissert. Abstr.

N84-15725 Arizona Univ., Tucson.
A NUMERICAL INVESTIGATION OF THE FORMATION OF SECONDARY VORTICES IN LABORATORY-SIMULATED TORNADOES Ph.D. Thesis
Robert Lambert Walko 1983 164 p
Avail: Univ. Microfilms Order No. DA8324466

Two numerical models, described in detail herein, have been constructed and used to investigate the formation of secondary vortices in axisymmetrically-forced rotating flows. The particular type of vortex flow examined is that developed in a laboratory vortex simulator where secondary vortices have been produced and extensively studied. The first numerical model generated a collection of steady state, axisymmetric vortex flows based on a range of swirl ratios. The second model tested those flows for instability by simulating the behavior of small amplitude, axially asymmetric, linear perturbations superimposed on the flows: amplification of the perturbations indicated instability whereas damping indicated stability. For those flows found to be unstable, the linear perturbations of various azimuthal wavenumbers were analyzed in detail, and from the perturbation growth rates, structures, phase speeds, and energetics, the nature of the instability could be studied. Dissert. Abstr.

N84-15726 Iowa State Univ. of Science and Technology, Ames.
A COMPARISON STUDY OF THE ENERGETICS OF STANDING AND TRANSIENT EDDIES BETWEEN TWO GENERAL CIRCULATION MODELS: THE GLAS CLIMATE MODEL AND THE NCAR COMMUNITY CLIMATE MODEL Ph.D. Thesis
Yen-Huei Lee 1983 204 p
Avail: Univ. Microfilms Order No. DA8323295

The energetics of standing and transient eddies simulated by the GLAS Climate Model (CM) and the NCAR Community Climate Model (CCM) in both winter and summer are compared in the physical and spectral domains to provide insight into their structure and maintenance and possible clues for the improvement of the models. Particlar attention is focused on the 3-dimensional distributions of the energetics of standing eddies. Contributions from the long-wave regime to the standing eddies are also examined. In the winter Northern Hemisphere, it is found that the structure of standing eddies is closely associated with the distribution of continents and oceans, and the maintenance of standing eddies is closely related to the jet streams. It is worth noting that over the eastern and western Pacific and Atlantic Oceans, where the standing eddy kinetic energy is most prominent, there are strong conversions from both the standing eddy available potential energy and the man zonal flow kinetic energy to the standing eddy kinetic energy. Dissert. Abstr.

N84-15727 Oklahoma Univ., Norman.
RELATIONSHIPS BETWEEN THUNDERSTORM MESOSCALE CIRCULATION AND TORNADOGENESIS Ph.D. Thesis
Edward Alan Brandes 1983 195 p
Avail: Univ. Microfilms Order No. DA8324873

A methodology for obtaining pressure and potential temperature deviations in thunderstorm flows reconstructed from Doppler radar observations is described. Results are combined with detailed vorticity analyses to study properties of severe thunderstorm circulations (mesocyclones) known to have spawned tornadoes. The data show that vertical vorticity production in tornadic storms begins at the very roots of the updraft horizontal vorticity associated with low level environmental air is tilted toward the vertical. The vertical vorticity produced is amplified by the convergence mechanism within strong updraft to create the low level mesocyclone. A sudden intensification of mesocyclone rotation, particularly at low levels, heralds the tornadic stage and transforms the mesocyclone. Updrafts and rainy downdrafts are strong at this critical stage and interact to locally increase convergence. Low level vorticity amplification by the convergence mechanism surges, exceeding maximum twisting term generation by a factor of 2 or more. Dissert. Abstr.

N84-15728 Pacific Northwest Lab., Richland, Wash.
SCALING WIND CHARACTERISTICS FOR DESIGNING SMALL AND LARGE WIND TURBINES
J. R. Connell and R. L. George May 1983 14 p refs Presented at the Am. Solar Energy Soc. Meeting, Minneapolis, 1 Jun. 1983 (Contract DE-AC06-76RL-01830)
(DE83-014501; PNL-SA-10860; CONF-830622-21) Avail: NTIS

HC A02

Stationally sampled wind speed spectra are required to explain the turbulence experienced by rotating wind turbine blades, methods of estimating the shape and magnitude of the rotationally sampled wind speed spectra are required to explain the turbulence experienced by rotating wing turbine blades, and methods of estimating the shape and magnitude of the rotationally sampled wind speed spectra for different sizes of turbines were developed. The primary model called STRS-2, is an empirical one that processes turbulence measurements from a single meteorological tower at any chosen site. The secondary model used is based upon homogeneous, isotropic turbulence theory. Several examples of direct measurement of rotationally sampled wind velocity for small turbines are used to complement the two models. It is indicated that all turbines will experience previously unanticipated turbulence in the higher frequency region. It is shown that character and intensity of rotational sampled wind vary with the variation of turbine diameter, hub height, and rotation rate in a predictable manner. DOE

N84-15729*# University Space Research Association, Huntsville, Ala. Visiting Scientist Program.

EVALUATION OF 2 1-D CLOUD MODELS FOR THE ANALYSIS OF VAS SOUNDINGS

G. D. Emmitt Washington NASA Jan. 1984 39 p refs
(Contract NAS8-34767)
(NASA-CR-3771; NAS 1.26:3771) Avail: NTIS HC A03/MF A01 CSCL 04B

Evaluation of the satellite Visual Infrared Spin Scan Radiometer Atmospheric Sounder (VISSR) has begun to document several of its critical shortcomings as far as numerical cloud models are concerned: excessive smoothing of thermal inversions; imprecise measurement of boundary layer moisture; and tendency to exaggerate atmospheric stability. The sensitivity of 1-D cloud models to their required inputs is stressed with special attention to those parameters obtained from atmospheric soundings taken by the VAS or rawinsonde. In addition to performing model experiments using temperature and moisture profiles having the general characteristics of VAS soundings, standard input sensitivity tests were made and 1-D model performance was compared with observations and the results of a 2-D model experiment using AVE/VAS data (Atmospheric Variability Experiment). Although very encouraging, the results are not sufficient to make any specific conclusions. In general, the VAS soundings are likely to be inadequate to provide the cloud base (and subcloud layer) information needed for inputs to current cumulus models. Above cloud base, the tendency to exaggerate the stability of the atmosphere requires solution before meaningful model experiments are run. Author

N84-15730*# Pennsylvania State Univ., University Park. Dept. of Meteorology.

UTILIZATION OF SATELLITE DATA IN MESOSCALE MODELS OF SEVERE WEATHER Final Report, 1 Apr. 1982 - 31 Mar. 1983

Thomas T. Warner Aug. 1983 8 p
(Grant NsG-5205)
(NASA-CR-175122; NAS 1.26:175122) Avail: NTIS HC A02/MF A01 CSCL 04B

The impact of the diagnostic initialization of divergence on short-range precipitation forecasts produced by a model, a numerical study of a storm, collaborative modeling and diagnostic studies, and a numerical investigation of the impact of SEASAT surface wind data used in the static initialization of the North Atlantic Storm of 9-10 September 1978 are summerized. Author

N84-15731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PILOT CLIMATE DATA SYSTEM: A STATE-OF-THE-ART CAPABILITY IN SCIENTIFIC DATA MANAGEMENT

Paul H. Smith, Lloyd A. Treinish, and Lawrence V. Novak Oct. 1983 20 p
(NASA-TM-85115; NAS 1.15:85115) Avail: NTIS HC A02/MF A01 CSCL 04B

The Pilot Climate Data System (PCDS) was developed by the Information Management Branch of NASA's Goddard Space Flight Center to manage a large collection of climate-related data of interest to the research community. The PCDS now provides uniform data catalogs, inventories, access methods, graphical displays and statistical calculations for selected NASA and non-NASA data sets. Data manipulation capabilities were developed to permit researchers to easily combine or compare data. The current capabilities of the PCDS include many tools for the statistical survey of climate data. A climate researcher can examine any data set of interest via flexible utilities to create a variety of two- and three-dimensional displays, including vector plots, scatter diagrams, histograms, contour plots, surface diagrams and pseudo-color images. The graphics and statistics subsystems employ an intermediate data storage format which is data-set independent. Outside of the graphics system there exist other utilities to select, filter, list, compress, and calculate time-averages and variances for any data of interest. The PCDS now fully supports approximately twenty different data sets and is being used on a trial basis by several different in-house research grounds. Author

N84-15732*# Atsuko Computing International, Huntsville, Ala.

ANALYSIS OF SEVERE STORM DATA Final Report

John S. Hickey 14 Nov. 1983 114 p
(Contract NAS8-34744)
(NASA-CR-170947; NAS 1.26:170947; ACI-111483-FR) Avail: NTIS HC A06/MF A01 CSCL 04B

The Mesoscale Analysis and Space Sensor (MASS) Data Management and Analysis System developed by Atsuko Computing International (ACI) on the MASS HP-1000 Computer System within the Systems Dynamics Laboratory of the Marshall Space Flight Center is described. The MASS Data Management and Analysis System was successfully implemented and utilized daily by atmospheric scientists to graphically display and analyze large volumes of conventional and satellite derived meteorological data. The scientists can process interactively various atmospheric data (Sounding, Single Level, Gird, and Image) by utilizing the MASS (AVE80) share common data and user inputs, thereby reducing overhead, optimizing execution time, and thus enhancing user flexibility, useability, and understandability of the total system/software capabilities. In addition ACI installed eight APPLE III graphics/imaging computer terminals in individual scientist offices and integrated them into the MASS HP-1000 Computer System thus providing significant enhancement to the overall research environment. Author

N84-15733# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

AIRBORNE LIGHTNING CHARACTERIZATION Final Technical Report, Jun. 1979 - Aug. 1982

P. L. Rustan (AFIT), B. P. Kuhlman (AFFDL), A. Serrano, J. Reazer, and M. Risley (Technology Scientific Services Inc.) Jan. 1983 186 p refs
(AF Proj. 2402)
(AD-A130627; AFWAL-TR-83-3013) Avail: NTIS HC A09/MF A01 CSCL 14/2

A WC-130 aircraft was instrumented with eleven electric and magnetic field sensors at different locations. The aircraft was flown in the vicinity of active thunderstorms at altitudes between 1500 and 16000 feet mean sea level (MSL). To correlate the electric fields produced by the lightning flashes and the respective location of the flashes, a ground station network was employed. The ground network consisted of a central station where the electric field and very high frequency (VHF) radiation were measured and four remote stations arranged in a wye configuration with a 20 kilometer (km) radius for measuring VHF. Fourteen channels of continuous analog data with 2 Mega hertz (MHz) bandwidth and ten channels of digital data of 164 microsecond (micro sec) windows with 20 MHz bandwidth at a maximum rate of two data windows per second were recorded in the aircraft. Analog data for the electric field and VHF radiation with 2 MHz bandwidth were recorded at the central ground site. In addition, VHF radiation

with 2 MHz bandwidth were recorded at the central ground site. In addition, VHF radiation with 4 MHz bandwidth was recorded in modified video cassette recorders at all four ground sites. IRIG-B time code received at the ground site was retransmitted to the aircraft and remote stations and used for time synchronization. The aircraft and ground sensors were calibrated to detect lightning flashes between zero and 35 km away. GRA

N84-15734# Range Commanders Council, White Sands Missile Range, N. Mex. Meteorology Group.
RANGE REFERENCE ATMOSPHERE 0-30 km ALTITUDE, EGLIN AFB, FLORIDA
Aug. 1983 177 p Revised
(AD-A133506; RCC/MG-367-83) Avail: NTIS HC A09/MF A01 CSCL 04/2

The RRA contains tabulations for monthly and annual means, standard deviations, and skewness coefficients for windspeed, pressure, temperature, density, water vapor pressure, virtual temperature, and dewpoint temperature; the means and standard deviations for the zonal (U) and meridional (V) wind components; and the linear (product moment) correlation coefficient between the wind components. These statistical parameters are tabulated at the station elevation, at 1-km intervals from sea level to 30 km, and at 2-km intervals from 30 to 90 km. The wind statistics are given at approximately 10 m above the station elevations and at altitudes with respect to mean sea level thereafter. For those range sites without rocketsonde measurements, the RRAs terminate at 30 km altitude, or they are extended, if required, when rocketsonde data from a nearby launch site are available. There are four sets of tables for each of the 12 monthly reference periods and the annual reference period. GRA

N84-15735# Digital Programming Services, Inc., Waltham, Mass.
DEVELOPMENT OF THEORETICAL MODELS AND ANALYSES OF THE MICRO-PHYSICS OF CLOUD AND PRECIPITATION SYSTEMS Final Report, 1 Aug. 1931 - 31 May 1983
Lawrence E. Belsky, Fredrick B. Kaplan, James P. Lally, D. Keith Roberts, Peter Miller, John Foley, and Terence OToole Hanscom AFB, Mass. AFGL 31 May 1983 229 p
(Contract F19628-81-C-0141; AF Proj. 2310)
(AD-A133557; AFGL-TR-83-0133) Avail: NTIS HC A11/MF A01 CSCL 04/2

This report summarizes the mathematical procedures used on a variety of standard and non-standard cloud physics data. It includes the complete descriptions and operating instructions for all programs developed under this contract. GRA

N84-15736# Range Commanders Council, White Sands Missile Range, N. Mex. Meteorology Group.
TAQUAC, GUAM ISLAND. RANGE REFERENCE ATMOSPHERE 0-30 km ALTITUDE
Sep. 1983 178 p
(AD-A133618; RCC/MG-368-83) Avail: NTIS HC A09/MF A01 CSCL 04/1

The RRA contains tabulations for monthly and annual means, standard deviations, and skewness coefficients for windspeed, pressure, temperature, density, water vapor pressure, virtual temperature, and dewpoint temperature; the means and standard deviations for the zonal (U) and meridional (V) wind components; and the linear (product moment) correlation coefficient between the wind components. These statistical parameters are tabulated at the station elevation, at l-km intervals from sea level to 30 km, and at 2-km intervals from 30 to 90 km. The wind statistics are given at approximately 10 m above the station elevations and at altitudes with respect to mean sea level thereafter. For those range sites without rocketsonde measurements, the RRAs terminate at 30 km altitude, or they are extended, if required, when rocketsonde data from a nearby launch site are available. There are four sets of tables for each of the 12 monthly reference periods and the annual reference period. Author (GRA)

N84-15737# California Univ., Livermore. Lawrence Livermore Lab. Atmospheric and Geophysical Sciences Div.
RESPONSE TO W. W. KELLOGG CARBON DIOXIDE AND CLIMATIC CHANGE: IMPLICATIONS FOR MANKIND'S FUTURE
Hugh W. Ellsaesser Oct. 1983 19 p refs Presented at the 12th Intern. Conf. on the Unity of the Sci., Comm. 6 on Global Environ. Probl., Chicago, 24-27 Nov. 1983
(Contract W-7405-eng-48)
(DE84-002723; UCRL-89964; CONF-8311100-1) Avail: NTIS HC A02/MF A01

The consensus that doubled CO2 levels will lead to a global temperature increase of 30C and the associated implications for mankind was argued. The reasons for doubting the majority view on two climatic feedback processes are presented: (1) the ice albedo feedback, and (2) the water vapor feedback. DOE

N84-15738# Oregon Univ., Eugene. Solar Radiation Monitoring Lab.
PACIFIC NORTHWEST SOLAR RADIATION DATA
1 Apr. 1983 148 p
(DE84-002335; DOE/BP-189) Avail: NTIS HC A07/MF A01

Daily solar radiation data are presented and the data analysis process and the accuracy of the data are discussed. Solar radiation in the Pacific Northwest to give an intuitive feeling for the data are reviewed. The establishment of the monitoring network is outlined. The data analysis procedures are then outlined and show what happens once the data are received. The calibration of the sensors is discussed. Comparisons with other sites and frequency distributions are described. The possible effect on the data of the volcanic eruption of El Chichon in Mexico are examined. Empirical correlations determined for the Pacific Northwest are used as the first step to determine the amount of solar radiation on a tilted surface. This is the first time that these correlations have been derived for the Pacific Northwest. DOE

N84-15739# Lamont-Doherty Geological Inst., Palisades, N. Y.
CLIMATE-CHEMISTRY CONNECTION
Wallace S. Broecker (ORNL) and Tsung-Hsung Peng 1983 32 p refs Presented at the 4th Symp. on Climate Processes: Sensitivity to Solar Irradiance and CO/sub 2, 25 Oct. 1982
(Contract W-7405-eng-26; Grants NSF DEB-81-15316; NSF OCE-80-19448)
(DE84-001950; CONF-821054-2) Avail: NTIS HC A03/MF A01

The impacts on ocean chemistry of a variety of scenarios capable of producing the 90 x 10(+6) atmosphere glacial to interglacial increase in CO2 were explored. It is shown that each scenario produces a unique combination of (13)C, Cd, O2 and CaCO3 dissolution responses. With reliable ocean wide records of these parameters, it is possible to greatly reduce the list of those scenarios capable of explaining this CO2 change. It is found that the only acceptable hypotheses are: (1) shelf deposition; (2) Redfield ratio change plus forest growth; or (3) phosphorite deposition plus forest growth. When global cadmium records become available further cuts will be possible. DOE

N84-15740# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abt. Meteorologische Modelle.
RADIATIVE-DYNAMIC PROPERTIES OF ARCTIC STRATUS CLOUDS AND THEIR POSSIBLE MODIFICATION BY AEROSOL PARTICLES
Peter Wendling Aug. 1983 29 p refs
(DFVLR-FB-83-23) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 12,50

The extent to which cloud optical properties might be influenced by an increased aerosol burden of the Artic region is estimated, based on radiative transfer calculations. The consequences for the radiation balance are discussed. It is shown that knowledge of the optical properties of Arctic stratus clouds is incomplete and there is an urgent need for additional field observations as well as further theoretical calculations on the microphysics and dynamics of Arctic stratus clouds. Author (ESA)

N84-15741# World Meteorological Organization, Geneva (Switzerland).
TROPICAL CYCLONE OPERATIONAL PLAN FOR THE SOUTH-WEST INDIAN OCEAN
1983 41 p
(WMO-618; ISBN-92-63-10618-5) Avail: NTIS MF A01; print copy available at WMO, Geneva SWFR 18

Internationally coordinated tropical cyclone warning systems for the Indian Ocean are outlined. The operational plan defines the forecasting and warning responsibilities of cooperating Members. It sets out existing arrangements in the region for provision of observational data and exchange of information and contains information on practices and procedures of regional significance. Information on national practices or other matters which are not the subject of consideration at international level but may be of interest to operational services is also given.
Author (ESA)

N84-15742# National Bureau of Standards, Washington, D.C.
SIMULATED PRECIPITATION REFERENCE MATERIALS, 4
W. F. Koch, G. Marinenko, and J. W. Stolz Jun. 1982 22 p refs Sponsored in part by the Environmental Research Center, Research Triangle Park, N.C.
(PB83-139378; NBSIR-82-2581) Avail: NTIS HC A02/MF A01

This report describes work performed at the National Bureau of Standards under the censorship of the United States Environmental Protection Agency to establish the composition of a fourth series of reference materials intended to be used for the intercalibration of precipitation measurement stations, to evaluate the stability of the first three series of reference materials, to evaluate current methodologies for pH and acidity measurements, and to make recommendations to improve future reference materials and measurement protocols.
Author (GRA)

N84-15743 Stanford Univ., Calif.
DEVELOPMENT AND PERTURBATION ANALYSIS OF MODEL STOCHASTIC EQUATIONS FOR GLOBAL CIRCULATION Ph.D. Thesis
John Lawrence Dunec 1983 358 p
Avail: Univ. Microfilms Order No. DA8320703

This thesis examines the characteristics of a perturbation technique applied to effect closure on a set of moment equations representing a highly idealized climate. It begins with a review of the development of the basic laws of fluid dynamics and reduces them to the two-dimensional, barotropic vorticity equation. This equation is modelled with the Lorenz minimum equations, a highly simplified model relating the dynamics of the first three modes of a spectral solution to the vorticity equation. The development and solution of these equations are reviewed, culminating in plots of the solution parameters as functions of initial conditions. A new coordinate system energy and enstrophy is introduced which reduces the solution parameters and bifurcation boundaries to two-dimensional entities. The averaging process defining the climate is analytically introduced into the equations, leading to a set of differential moment equations. Any given moment is coupled to the next higher moment, creating a closure problem.
Dissert. Abstr.

N84-15087# Royal Aircraft Establishment, Bedford (England).
WORLDWIDE EXPERIENCE OF WIND SHEAR DURING 1981-1982
A. A. Woodfield and J. F. Woods *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 32 p refs (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-16029*# Texas A&M Univ., College Station. Dept. of Meteorology.
INVESTIGATION OF THE ARC CLOUD COMPLEX
Kenneth C. Brundidge *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 27 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N84-15744# Coastal Engineering Research Center, Vicksburg, Miss.
PROTOTYPE TIDAL DATA ANALYSIS FOR MISSISSIPPI SOUND AND ADJACENT AREAS Final Report
Douglas G. Outlaw Sep. 1983 189 p
(AD-A134071; CERC-83-1) Avail: NTIS HC A09/MF A01 CSCL 08/3

Prototype tidal elevation and current data acquired in Mississippi sound during the spring, summer, and fall 1980 were analyzed as a part of a study to establish existing hydrodynamic conditions and to estimate changes in tidal and wind-driven circulation patterns for proposed dredged material disposal practices. The results of the prototype tidal data analysis will be used for numerical tidal circulation model calibration and verification. The results also provide a characterization of the tidal regime in the study area. Data were included in the analysis from 22 surface elevation stations, three bottom pressure stations in the Gulf, and 21 velocity stations. Conductivity/temperature transect data were collected for 40 stations at intervals of approximately 3 weeks during the data acquisition period. Tidal analysis results show that the diurnal O1 and K1 surface elevation constituents have the largest amplitude in the Mississippi Sound study area, with an amplitude of approximately 0.5 ft. Principal semidiurnal surface elevation tidal constituents were M2 and S2, with amplitudes of 0.13 ft or less. Minimum salinity levels were observed near Lake Borgne in the western part of the Sound.
GRA

N84-15745# Woods Hole Oceanographic Institution, Mass.
THE LONG TERM UPPER OCEAN STUDY (LOTUS). CRUISE SUMMARY AND HYDROGRAPHIC DATA REPORT, ENDEAVOR 97, APRIL 1983
Richard P. Trask and Melbourne G. Briscoe Oct. 1983 48 p
(Contract N00014-76-C-0197)
(AD-A134005; WHOI-83-33) Avail: NTIS HC A03/MF A01 CSCL 08/10

ENDEAVOR cruise number 97 (8-19 April, 1983) was the ninth scheduled cruise to the Long Term Uppe. Ocean Study (LOTUS) area centered at 34 N, 70 W. During the cruise three LOTUS moorings (a near-surface and tow subsurface moorings) deployed eleven months earlier were recovered and replaced by a nearly identical set of moorings. The new array will remain in the water during the final year of LOTUS field work. The LOTUS surface mooring, scheduled to be recovered during ENDEAVOR 97, had been partially recovered one month earlier after the mooring parted and drifted off station. The lower portion of the surface mooring which went to the bottom when the mooring failed was successfully recovered during ENDEAVOR 97. A new surface mooring replacing the one failed was successfully recovered during ENDEAVOR 97. A new surface mooring replacing the one that parted and a C.S. Draper Labs profiling current meter mooring were also set during the cruise. Non-mooring work included deploying three satellite tracked drifter buoys and completing five CTD stations in the LOTUS area. Several intercomparisons between shipborne meteorological sensors and similar sensors on the Lotus surface buoy and the drifter buoys were made. An XBT section was also completed along 70 W between 40 N and 34 N. Part I of this report is a summary of the major cruise activities and part II presents the hydrographic data (CTD and XBT) collected during the cruise.
GRA

N84-15746# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
AN ANALYSIS OF AIRCRAFT DATA COLLECTED IN THE ALBORAN SEA DURING DONDE VA?, 6 - 18 OCTOBER 1982 Final Report
Paul E. La Violette and Jeffrey L. Kerling Jul. 1983 122 p
(AD-A133995; NORDA-TN-222) Avail: NTIS HC A06/MF A01 CSCL 08/10

During the period 6-18 October 1982, a U.S. Navy aircraft flew a series of oceanographic survey flights over the Alboran Sea as part of a multi-platformed international experiment called Donde Va? The purpose of the flights was to measure the surface and subsurface temperature distribution, the short-term surface flow, and the atmospheric conditions during the period of the intensive field investigations. This technical note describes these flights and presents the analyses of the Precision Radiation Thermometer (PRT-5), the Airborne Expendable Bathythermograph (AXBT), the sonobuoy drift, and the Inertial Navigation System (INS) wind data. Author (GRA)

N84-15747# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
SNOW THICKNESS AND BRIGHTNESS TEMPERATURE ON MULTI-YEAR ICE Final Report, period ending FY 1980
A. W. Lohanick Nov. 1982 15 p
(AD-A133940; NORDA-TN-171) Avail: NTIS HC A02/MF A01 CSCL 08/12

The 33 GHz brightness temperature (Tb) of a 40-meter strio of multi-year ice was obtained using a sled-mounted radiometer. Snow accumulations along the strip varied from 0 to 40 cm. After the snow was removed, Tb was re-measured. Detailed comparisons of snow depth vs. change in Tb show that snow thickness or snow water equivalent alone are not sufficient to describe the emissivity of the snow pack. Author (GRA)

N84-15748# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
EXPENDABLE BATHYTHERMOGRAPH (XBT) MEASUREMENTS IN THE WESTERN ALBORAN SEA, OCTOBER 1982 Final Report
Mark T. Bergin and Thomas H. Kinder Aug. 1983 102 p
(AD-A133939; NORDA-TN-224) Avail: NTIS HC A06/MF A01 CSCL 08/10

USNS BARTLETT dropped 152 expendable bathythermographs (XBT) in the western Alboran Sea during 6-18 October 1982 as part of an international oceanographic research project entitled Donde Va? The XBT data were taken to obtain synoptic temperature sections across the inflowing Atlantic Jet and the Alboran Gyre, and in the Strait of Gibraltar. XBT data were also used to increase the resolution of standard hydrographic (CTD: conductivity-temperature-depth profiler) sections. A plot of temperature versus depth for each XBT drop to 200 dbar (temperatures below 200 dbar were nearly constant) is shown. Author (GRA)

N84-15749# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
THE ADVECTION OF SUBMESOSCALE THERMAL FEATURES IN THE ALBORAN SEA GYRE
Paul E. LaViolette Sep. 1983 39 p
(AD-A133877; NORDA-TN-240) Avail: NTIS HC A03/MF A01 CSCL 08/10

Continuous monitoring of these cold-water features using satellite imagery is possible because of the twice-daily (every 12-hours) spacing of the NOAA-7 coverage of the area. After registration to a mercator projection and atmospheric correction, analysis of the displacement of the cold water features in successive imagery show their apparent origin to be just east of Gibraltar, their movement at average speeds of 0.4 m/sec around the Gyre, and their apparent reentrainment into the incoming Atlantic water east of Gibraltar. The NIMBUS-7 CZCS imagery supplements the analysis by adding details of the movement and to the theory on where the cold-water features originate. During the fifteen-day period, nine cold-water features were thermally distinct enough to be tracked for several days. Aircraft and ship oceanographic data collected during the period show the cold surface features were associated with upwelled water from greated than 100 meters depth and based on temperature and salinity data, appear to be of Atlantic origin. Sonobuoy drift data indicate the features were part of the incoming Atlantic jet. While the speed of the features varied from day-to-day ranging from 0.2 to 0.6 m/sec, comparison with meteorological data does not indicate that these differences were related to variations in direction or strength of the wind. It is hypothesized from the limited amount of data available at this time that the features are associated with the tidal movement exiting the Strait of Gibraltar. GRA

N84-15750# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
SHORT-TERM MEASUREMENTS OF SURFACE CURRENTS ASSOCIATED WITH THE ALBORAN SEA DURING DONDE VA?
Paul E. LaViolette Sep. 1983 36 p
(AD-A133812; NORDA-TN-241) Avail: NTIS HC A03/MF A01 CSCL 08/3

During the period 6 through 18 October 1982, six flights by a U.S. Navy research aircraft were made over the Alboran Sea Gyre as part of the Donde Va? experiment. During five of these flights, sonobuoys were dropped in a linear pattern designed to show the temporal and spatial variability of the current which constitute the gyre. A normal deployment consisted of approximately 15 sonobuoys dropped along the longitudinal line 4 deg 45 min W from the Spanish coast to within 30 km of the Moroccan coast. During the following four hours, the sonobuoys were located twice, their positions noted, and their individual drift speeds and directions derived. Aircraft precision radiation temperature and aircaft expendable bathythermograph data were collected concurrently with the sonobuoy drops to determine the thermal structure of the water during the drift period. Inertial navigation winds as well as other meteorological data, were also collected by the aircraft. Analysis of these data show that the cold (aprox 17 C) outer portion of the Alboran Sea Gyre was the main constituent of the jet. These cold waters reached speeds of greater than 1.2 m/sec as compared to average speeds of 0.6 m/sec for the warmer water of the gyre. Examination of the aircraft meteorological meaurements as well as data relating to the short-term atmospheric conditions i.e., for the 12-day period of the study) did not indicate that meteorological factors had a major influence on the speed of the currents or the position of the gyre during the period of study. Author (GRA)

N84-15751# JAYCOR, Alexandria, Va.
ELLIPTIC SOLVERS FOR NORDA OCEAN MODELS AND A QUASI-GEOSTROPHIC REGIONAL EDDY-MEAN ENERGETICS PACKAGE Final Report, 15 Mar. 1982 - 14 Mar. 1983
Alan J. Wallcraft 12 Aug. 1983 53 p
(Contract N00014-82-C-0394)
(AD-A133754; AD-F300330; JAYCOR-J206-83-007/6221) Avail: NTIS HC A04/MF A01 CSCL 08/10

All two dimensional Helmholtz solvers for rectangles at NORDA have been placed in one library with standardized naming and argument list conventions. Each solver has full internal documentation, test software for accuracy, timing and error conditions (such as incorrect dimensions, etc.). The internal documentation for three representative solvers (SMNUUH, SMNSUH and SMMSSH) is reproduced. To invoke a solver, two routines must be called. The first (e.g., CMNUUH) tests the correctness of the arguments and produces constants for use by the solver proper; it need be called only once for each different Helmholtz operation (i.e., it does not depend on the right hand side of the equation). The second (e.g., SMNUUH) when called with the precalculated constants and a right hand side array actually supplies the solution to Helmholtz's equation, it must obviously be called once for each solution required. GRA

N84-15752# JAYCOR, Alexandria, Va.
RESULTS FROM A TWO-LAYER AND A REDUCED GRAVITY MODEL OF THE ALBORAN SEA; AND VERTICAL SHEAR FROM TOPS Final Report, 3 Aug. 1982 - 12 May 1983
Ruth H. Preller 12 Sep. 1983 76 p
(Contract N00014-82-C-0761)
(AD-A133753; AD-F300330; JAYCOR-J206-83-009/6226) Avail: NTIS HC A05/MF A01 CSCL 08/10

This study has attempted to simulate the statistics of temporal and geographical distribution of shear over the upper 400 m of

the world's oceans. In particular we have examined a large area of the North Pacific over the six month period March through August of 1981. Forcing was provided by the prediction fields obtained from FNOC's hemispheric weather model. Model results have shown: Surface shear increases from late winter - early spring to summer; The region south-southwest of the Bering Sea develops into a region of very high surface shear in spring and summer; The depth to which shear extends is closely correlated to the mixed layer depth, thus in winter shear values are found at greater depths than in summer; Seasonal comparisons show that the magnitude of shear is larger in May than in November, but extends to greater depths in November than in May; Shear instability is strongly linked to the passage of atmospheric fronts. Regions of stability occur under high pressure systems and low winds; Very little convective instability exists during the six month period examined (Ri < 0). GRA

N84-15753# Scripps Institution of Oceanography, La Jolla, Calif. Marine Physical Lab.
PROGRAM IN MARINE PHYSICS APPLIED TO NAVY UNDERSEA MISSIONS Final Report, 1 Nov. 1979 - 30 Sep. 1982
V. C. Anderson and F. N. Spiess 8 Jun. 1983 18 p
(Contract N00014-80-C-0077)
(AD-A133119; MPL-U-42/83) Avail: NTIS HC A02/MF A01 CSCL 08/10

This final report is a summary of the core program at the Marine Physical Laboratory. The overall core program addresses in a coordinated way the acoustic, hydrodynamic and magnetic environments of the ocean and the opportunities of constraints which knowledge of the environment produces in relation to undersea detection, localization and communication. Projects within these sections interacted among one another through sharing of ideas and technological background within the scientific and engineering staff and through sharing of facilities both ashore and afloat. The core program improved in a correlated way both the basic understanding of oceanic phenomena and the generation and testing of concepts for carrying out sensing and communication tasks in the sea in the most efficient manner. Author (GRA)

N84-15754# Washington Univ., Seattle. Applied Physics lab.
XCP MEASUREMENTS OFF CALIFORNIA IN OCTOBER 1982: CRUISE REPORT AND PRELIMINARY RESULTS Final Report
Eric A. DAsaro Aug. 1983 33 p
(Contract N00014-82-C-0038)
(AD-A133051; APL-UW-8310) Avail: NTIS HC A03/MF A01 CSCL 08/3

Sixty nine profiles of horizontal velocity and temperature from the surface to about 800 m were made using the Expendable Current Profiler (XCP) during De Steiguer cruise 1212, 7-18 October 1982. The XCP's were deployed in a 6 day time series behind a drogued buoy and in a 275 n.mi. zigzag spatial survey. Satellite infrared images were used to locate a cruise area away from strong mesoscale features. The measurements were designed to estimate the horizontal coherence function of the near-inertial frequency internal wave field for comparison with similar measurements made in the Sargasso Sea. It was found that the near-inertial waves are a dominant feature of the velocity field. Significant coherence exists between nearby profiles. It will, therefore, be possible to compute a correlation function for these data as planned. A near-surface feature with peak-to-peak velocities of 70 cm/s was observed and partially surveyed. Author (GRA)

N84-15673*# Scripps Institution of Oceanography, La Jolla, Calif. Visiblity Lab.
PASSIVE REMOTE SENSING OF OCEAN OPTICAL PROPAGATION PARAMETERS
Roswell W. Austin and Benjamin L. McGlamery *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 11 p refs (For primary document see N84-15646 06-43)
(Contracts NAS5-26249; N00014-78-C-0566)
Avail: NTIS HC A17/MF A01

N84-15675# SRI International Corp., Menlo Park, Calif.
IN SITU CHARACTERIZATION OF SEAWATER USING A COMPUTERIZED SUITE OF OPTICAL INSTRUMENTS
Richard C. Honey and Chester A. Moore *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 12 p refs (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N84-15755*# Oregon Health Sciences Univ., Portland. Dept. of Neurology.
COUNTERCURRENT DISTRIBUTION OF BIOLOGICAL CELLS Final Report, 16 Nov. 1979 - 31 Dec. 1982
D. E. Brooks 1982 86 p refs
(Contract NAS8-33575)
(NASA-CR-170958; NAS 1.26:170958) Avail: NTIS HC A05/MF A01 CSCL 06C

Detailed physiochemical studies of dextran/poly(ethylene glycol) (PEG) two phase systems were carried out to characterize and provide understanding of the properties of the systems which determine cell partition and the electrophoretic behavior of phase drops responsible for electric field driven phase separation. A detailed study of the electrostatic and electrokinetic potentials developed in these systems was carried out. The salt partition was examined both in phase systems and with pure polymer solutions via equilibrium dialysis and mechanism of sulfate, chloride and phosphate partition shown to be exclusion by PEG rather than binding by dextran. Salt partition was shown to have a strong effect on the polymer compositions of the phases as well, an effect which produces large changes in the interfacial tension between them. These effects were characterized and the interfacial tension shown to obey a power law with respect to its dependence on the length of the tie line describing the system composition on a phase diagram. The electrostatic potential differences measured via salt bridges were shown to obey thermodynamic predictions. The electrophoretic mobilities measured were utilized to provide a partial test of Levine's incomplete theory of phase drop electrophoresis. The data were consistent with Levine's expression over a limited range of the variables tested. Author

N84-15756# Washington Univ., Seattle. Bioelectromagnetics Research Lab.
EFFECTS OF LONG-TERM LOW-LEVEL RADIOFREQUENCY RADIATION EXPOSURE ON RATS. VOLUME 1: DESIGN, FACILITIES, AND PROCEDURES Final Report, Jun. 1980 - Dec. 1982
Arthur W. Guy, Chung-Kwang Chou, Robert B. Johnson, and Lawrence L. Kunz Sep. 1983 83 p
(Contract F33615-80-C-0612; AF Proj. 7757)
(AD-A134079; SR-18-Vol-1; SAM-TR-83-17-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 06/18

This is the first of a series of reports on the effects of long-term low-level RFR exposure on rats. The design, facilities, and procedures for exposing 100 experimental and 100 sham-exposed rats to 2450-MHz pulsed electromagnetic fields are described. The rats were exposed to 10-microsecond pulsed microwaves at 800 pps and 8-Hz modulation for 21 h per day for 25 months at an average power density of 480 microwatts/sq cm. The maximum specific absorption rate in rats was 0.4 W/kg. Reports on individual endpoints are presented in subsequent reports. GRA

N84-15757# Harvard Univ., Cambridge, Mass. Lab. of Microbial Ecology.
THE ROLE OF MICROORGANISMS IN MARINE CORROSION PROCESSES Annual Technical Report, 1 Jul. 1982 - 30 Jun. 1983
Ralph Mitchell, Marianne Walch, and Francisco Tomei Apr. 1983 46 p

(Contract N00014-81-K-0624)
(AD-A133113; ATR-2) Avail: NTIS HC A03/MF A01 CSCL 06/13

This report describes research into the role of bacteria in marine corrison processes. During the past year we have studied four aspects of biological corrison; the mechanisms of attachment of bacteria involved in corrison to metal surfaces, corrison by extremely thermophillic bacteria, anaerobic corrison processes, and hydrogen embrittlement. Both quantitative and qualitative differences in the attachment microflora were detected on different metal surfaces. Hydrophobicity of the bacteria appears to control specificity of attachment. Extremely thermophillc bacteria appear to be common on surfaces in contact with hot water. Bacteria are well known as catalysts in anaerobic corrison processes. Bacteria appear to play an important role in hydrogen embrittlement of metals. Bacteria capable of producing large quantities of bacteria are found in microbial biofilms on metal surfaces. GRA

N84-15758# Letterman Army Inst. of Research, San Francisco, Calif. Toxicology Group.
ACUTE INTRAMUSCULAR TOXICITY (LD50) OF 1,1'-TRIMETHYLENEBIS (4-(HYDROXYIMINOMETHYL) PYRIDINIUM BROMIDE) MONOHYDRATE, (TMB-4) IN MALE MICE Final Report, 9 Jun. - 1 Jul. 1982
Craig W. White, Leonard J. Sauers, Thomas P. Kellner, and John T. Fruin Aug. 1983 27 p
(AD-A133148; LAIR-158; Toxicology-Ser-42) Avail: NTIS HC A03/MF A01 CSCL 06/20

The acute intramuscular toxicity of 1,1'-trimethylenebis4-(HYDROXYIMINO-METHYL) PYRIDINIUM BROMIDE monohydrate (TMB-4) (TW006) was determined in male ICR mice by using the single dose method. LD1, LD50, LD95 with their 95% confidence limits were calculated by probit analysis. The LD50 was 100 mg/kg with the 95% confidence limit (91 mg/kg, 110 mg/kg). The TMB-4 formulation falls in the very toxic range. Author (GRA)

N84-15759# OPTRA, Inc., Everett, Mass.
RAPID IDENTIFICATION OF MICRO-ORGANISMS
Michael Hercher and Kathleen Mead Aug. 1983 13 p
(Contract DAAG29-82-C-0011)
(AD-A132831; ARO-18828.1-LS-S) Avail: NTIS HC A02/MF A01 CSCL 06/13

Research reported here is concerned with an investigation of two new fluorescent techniques for the rapid identification of microorganisms: (1) membrane potential dyes for the discrimination of viable microorganisms in particulate samples, and (2) a proprietary immunofluorescent technique which will allow the individual presence of several different antigens to be detected in a single measurement. GRA

N84-15760# School of Aerospace Medicine, Brooks AFB, Tex.
DURATION OF MEMORY LOSS DUE TO ELECTRON BEAM EXPOSURE Final Report, Jan. - May 1983
Thomas G. Wheeler and Bert M. Tilton Aug. 1983 12 p
(AF Proj. 7757; U99QMXM)
(AD-A132941; SAM-TR-83-33) Avail: NTIS HC A02/MF A01 CSCL 06/18

Electron beam exposure has been shown to produce retrograde amnesia (RA). The objective of this study was to determine the duration of memory loss upon electron beam exposure. It is important to know if exposure produces a memory loss of the events which occurred in the preceding 1 sec or memory loss of the preceding minute's events. The task was a single-trial avoidance paradigm. The animal was placed in a small aversive chamber. After a 90-sec adaptation period, a door opened that provided access to a large, dark, preferred chamber. The time required for the animal to enter the preferred chamber was the measure of interest (T). Once inside the preferred chamber, a 1-sec footshock was delivered. Following the footshock by some preset delay (delta T), the animal was exposed to a 10-microsec, 10-rad electron beam (or X-ray). A second trial on the task was run 2 hr postexposure. The second trial consisted of placing the animal in the aversive chamber and monitoring the time (T') required to enter the preferred chamber. If the electron beam exposure interfered with the animal's ability to recall the shock, T' would be greatly reduced as compared with the sham controls. The exposure delay times used were delta T = 1, 3, 5, and 10 sec. GRA

N84-15761# Wisconsin Univ., Madison. Dept. of Medical Physics.
BONE BLOOD FLOW MEASURED BY (41)Ar CLEARANCE FORMED BY (44)Ca(n,(-)) (41)Ar
M. S. Rosenthal, P. M. DeLuca, Jr., D. W. Pearson, and R. J. Nickles 1983 18 p refs
(Contract DE-AC02-76EV-01105)
(DE83-017600; DOE/EV-01105/304) Avail: NTIS HC A02/MF A01

A technique to measure regional inert gas washout in bone, in vivo, by measuring (41)Ar clearance formed by fast-neutron activation of (44)Ca was developed. Following fast neutron irradiation of whole rats, the perfusion-limited clearance of (41)Ar was measured for both dead and living rats. It is indicated that in the clearance rate for the live rats the bone perfusion is in the range of 3 to 20 ml/100 Argon distribution volume. DOE

N84-15762# California Univ., Berkeley. Lawrence Berkeley Lab. Biology and Medicine Div.
LETHAL, POTENTIALLY LETHAL LESION MODEL
S. B. Curtis Jul. 1983 25 p refs Presented at the 7th Intern. Congr. of Radiation Res., Amsterdam, 4-9 Jul. 1983 and at the 11th L. H. Gray Conf., Glasgow, 18-22 Jul. 1983
(Contract DE-AC03-76SF-00098)
(DE84-001325; LBL-16549; CONF-830782-2) Avail: NTIS HC A02/MF A01

A theoretical framework to describe the formation of lethal mutations by radiation is presented. Lesions that are repaired and misrepaired are assumed to be the same. In this model the same lesions cause both sublethal and potentially lethal damage. Potentially lethal damage is damage which may be modified by alterations in postirradiation conditions. Sublethal damage is cellular damage whose accumulation may lead to lethality. The expression of the damage and the kind of medium in which the cells are placed during the repair period is considered. Fresh or growth medium (F-medium) is assumed to cause fixation of damage after about 3 hours, while no fixation occurs in conditioned medium (C-medium). DOE

N84-15190# Council for Scientific and Industrial Research, Pretoria (South Africa).
BIOLOGICAL CHEMISTRY
In its Activities of the National Chemical Research Lab. 1982 p 19-28 (For primary document see N84-15188 06-23)
Avail: NTIS HC A07/MF A01

N84-16027*# Jackson State Univ., Miss. Dept. of Biology.
A PRELIMINARY SURVEY OF PLANKTON AND PERIPHYTON IN THE TURN BARGE CANAL AND BASIN AREA OF KENNEDY SPACE CENTER, FLORIDA
Grover D. Barnes *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship program Dec. 1983 26 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 06C

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N84-15763* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 252)
1983 69 p
(NASA-SP-7011(252); NAS 1.12/7:7011(252)) HC A02/MF A01 CSCL 06E

This bibliography lists 204 reports, articles and other documents introduced into the NASA scientific and technical information system in November 1983. Author

N84-15764*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW X-RAY ABSORPTION ANEURISM CLIPS Patent Application
Robert M. Baucom, inventor (to NASA) Filed 10 Feb. 1983 10 p
(NASA-Case-LAR-12650-2; US-Patent-Appl-SN-465363) Avail: NTIS HC A02/MF A01 CSCL 06C

An X-ray transparent and biological inert medical clip for treating aneurisms and the like is disclosed as well as a process for its production. A graphite reinforced composite film is molded into a unitary structure having a pair of hourglass like cavities which are hinged together with a pair of jaws for grasping the aneurism extending from the wall of one cavity. A silicone rubber pellet is disposed in the other cavity to exert a spring force through the hinge area to normally bias the jaws into contact with each other. NASA

N84-15765# Tufts Univ., Boston, Mass. Musculo-Skeletal Research Group.
STRESS FRACTURES: THE REMODELLING RESPONSE TO EXCESSIVE REPETITIVE LOADING
C. T. Rubin, J. McA. Harris, B. H. Jones, H. B. Ernst, and L. E. Lanyon 6 Jul. 1983 7 p
(Contract DAAK60-83-C-0031)
(AD-A130881) Avail: NTIS HC A02/MF A01 CSCL 06/5

The occurrence of stress fractures indicates a failure to maintain an adequate match between bones structure and their functional requirement. Stress fractures occur both in well-trained athletes pushing for the limits of their performance, and in poorly-trained people, particularly women, following an abrupt change or increase in the level of their physical activity. The conventional view of the etiology of the training up type of stress fracture is that the remodelling processes are incapable of completing the necessary structural alterations before continued loading causes failure due to fatigue in the bone material. GRA

N84-15766# Colorado Univ., Denver. Cardiovascular Pulmonary Research Lab.
INCREASED METABOLISM AND DEAD SPACE AS COMPONENTS OF VENTILATION AT HIGH ALTITUDE
S. Y. Huang, J. K. Alexander (Baylor Univ.), R. F. Grover, J. T. Maher (Army Research Inst. of Environmental Medicine), R. E. McCullough, L. G. Moore, J. V. Weil, J. B. Sampson, and J. T. Reeves (Army Research Inst. of Environmental Medicine) 12 Jul. 1983 21 p refs
(Contract DAMD17-81-C-1057; Grant NIH-HL-14985; DA Proj. 3E1-162777-A-879)
(AD-A130827) Avail: NTIS HC A02/MF A01 CSCL 06/19

Ventilatory acclimatization to high altitude results in alveolar hyperventilation, which is an increase in alveolar ventilation per unit of carbon dioxide production and is associated with a fall in the PCO2. A measurement frequently made during acclimatization to high altitude is the total volume of air expired per minute, the minute ventilation. However, the relation of total to alveolar ventilation and the influence of CO2 production on the latter at high altitude is unclear. We sought to determine the contribution of changes in metabolism and in dead space ventilation to the increase in minute ventilation observed with ascent and during exposure to high altitude. In 12 healthy male subjects taken from Denver, Colorado (1600 M) to Pikes Peak, Colorado (4300 M) for 5 days, resting minute ventilation increased from low to high altitude (+35% by day 5) and arterialized venous PCO2 fell. Resting metabolic rate (VCO2) increased 16% by day 5 and could account for approximately half of the increase in minute ventilation. The increases in ventilation on days 1, 2 and 4 were positively correlated with increased CO2 production; they were not correlated with arterial oxygen saturation on any day. During exercise at high altitude, minute ventilation rose above low altitude values but less than 10% of the increase in ventilation could be attributed to increased CO2 production. Dead space ventilation at high altitude was the same as at low altitude in resting subjects. GRA

N84-15767# Army Research Inst. of Environmental Medicine, Natick, Mass.
THE EFFECTS OF DEHYDRATION ON PERIPHERAL COOLING
Donald E. Roberts, J. J. Berberich, and R. E. Droege 1983 27 p refs
(AD-A130838; USARIEM-M36/83) Avail: NTIS HC A03/MF A01 CSCL 06/19

Ten men were dehydrated by voluntary restriction of fluid intake and by mile exercise over a 2-1/2 day period (body weight loss: 4.6%). Body weight returned to -16% and -0.3% of their starting weight 10 to 20 hours after rehydration, respectively, suggesting the weight loss was fluid loss. Measures of blood and urine constituents also were indicative of dehydration. These 10 experimental subjects experienced a standard cold test prior to and after dehydration and after rehydration. The standard cold test consisted of sitting in a cold chamber (0 c) dressed in cold weather clothing with right hand bare for 2 hours. The fingers, but not the back of the hand, of the experimentals were significantly colder (P.05) following dehydration and were slightly warmer following initial rehydration. A group of 10 control subjects tested under identical conditions, but hydrated at all times, showed no changes. Author (GRA)

N84-15768# Colorado Univ., Denver. Cardiovascular Pulmonary Research Lab.
VARIABLE INHIBITION BY FALLING CO2 OF HYPOXIC VENTILATORY RESPONSE IN MAN
Lorna Grindlay Moore, S. Y. Huang, R. E. McCullough, J. B. Sampson (Army Research Inst. of Environmental Medicine), J. T. Maher (Army Research Inst. of Environmental Medicine), J. V. Weil, R. F. Grover, J. K. Alexander (Baylor College of Medicine), and J. T. Reeves 21 Jun. 1983 17 p refs
(Contract DAMD17-81-C-1057; Grant NIH-HL-14985; DA Proj. 3E1-16777-A-879)
(AD-A130658; USARIEM-M32/83) Avail: NTIS HC A02/MF A01 CSCL 06/19

Acute hypoxia stimulates an increase in ventilation but the resulting hypocapnia limits the magnitude of the increase. Thus, the hypoxic ventilatory response is usually measured during isocapnia, but this may not reflect events at high altitude. Possibly the degree of inhibition by hypocapnia might depend on individual ventilatory response to CO2 and thus vary between persons. If so, it might be useful to compare between individuals an isocapnic hypoxic ventilatory response (PACO2 maintained by CO2 addition) with a response in which CO2 was not added and the PACO2 fell to a variable extent (poikilocapnic hypoxia). We found in 14 healthy persons that, although the poikilocapnic hypoxic ventilatory response positively correlated with the isocapnic hypoxic response, the relation was improved by a multiple regression which included the negative association with the normoxic hypercapnic response. Thus the magnitude of the difference between the isocapnic and the poikilocapnic hypoxic responses related to the hypercapnic response (p less than .001). In those subjects with small hypercapnic responses, a falling CO2 during hypoxia had little depressant effect on the hypoxic ventilatory responses. GRA

N84-15769# Army Research Inst. of Environmental Medicine, Natick, Mass.
DIFFERENTIATED RATINGS OF PERCEIVED EXERTION AND SELECTED PHYSIOLOGICAL RESPONSES DURING PROLONGED UPPER AND LOWER BODY EXERCISE
Kent B. Pandolf, Darren S. Billings, Lawrence L. Drolet, Nancy A. Pimental, and Michael N. Sawka Oct. 1983 26 p
(DA Proj. 3E1-62777-A-879)
(AD-A134086; USARIEM-M-2/84) Avail: NTIS HC A03/MF A01 CSCL 06/19

This study examined whether prolonged exercise employing upper or lower body muscle groups led to significant alterations in differentiated ratings of perceived exertion (diff RPE). Nine

volunteer males performed 60 min of arm crank (AC) and cycle (CY) exercise at similar absolute (ABS) and at similar relative (REL) exercise intensities. There were no significant differences ($P > 0.05$) between AC and CY for oxygen uptake (VO2) during the ABS tests (about 1.60 1/min) or in percent ergometer specific peak VO2 during the REL tests (about 60%). Diff RPE included local RPE (muscle and joint exertion), central RPE (ventilatory and circulatory exertion), and overall RPE. During the ABS tests, the final means for all three diff RPE were lower ($P < 0.05$) for CY than AC exercise. No differences ($P > 0.05$) were found during the REL tests between AC and CY exercise for any of the diff RPE. Local RPE was generally higher than central RPE. Selected physiological responses accounted for more total variance in all diff RPE for AC than CY exercise. These data indicate that diff RPE may be more closely related to relative exercise intensity, and perceptual cues may be more readily monitored from smaller muscle masses such as the upper body. GRA

N84-15770# SRI International Corp., Menlo Park, Calif.
SPATIOTEMPORAL CHARACTERISTICS OF VISUAL LOCALIZATION Annual Technical Report, 1 Jun. 1982 - 31 May 1983
Christina A. Burbeck 15 Jul. 1983 15 p
(Contract F49620-82-K-0024; AF Proj. 2313)
(AD-A133952; AFOSR-83-0832TR) Avail: NTIS HC A02/MF A01 CSCL 05/10

A computer-based display system has been designed and built enabling the investigation of the processes underlying spatial localization. Among the results obtained in the past year with the use of this device are: (a) Eye movements play a significant role in spatial localization that is not limited to positioning the stimulus array optimally on the retina. (b) Neither retinal image drift nor abrupt movement of the retinal image is sufficient to restore normal performance on a localization task when the effects of eye movements on retinal image position are eliminated. (c) Preliminary data indicate that localization is a very slow process, much slower than form detection. In related work it has been shown that for some simple forms (sine wave gratings) the relative orientation of the stimuli does not affect ability to detect small differences in their sizes and conversely a difference in size between two stimuli does not affect ability to detect a small difference in their orientations. Further it has been found that the detection of small differences in size between two objects is masked strongly by stimuli consisting of fine lines but not by stimuli consisting of broader lines (high and low spatial frequency gratings respectively). It has also been found that eye movements are essential to the discrimination of objects on the basis of hue except in the yellow region of the spectrum. GRA

N84-15771# Saint Louis Univ., Mo. School of Medicine.
EXPERIMENTS ON FACTORS THAT INFLUENCE MUSCULAR FUNCTION IN MAN Final Report, Jul. 1980 - Sep. 1982
A. R. Lind, C. A. Williams, and M. D. Hoffman 25 May 1983 79 p
(Grant AF-AFOSR-0221-80; AF Proj. 2312)
(AD-A133928; AFOSR-83-0859TR) Avail: NTIS HC A05/MF A01 CSCL 06/16

Research was concerned with muscular function and fatigue. The systemic cardiovascular responses are much the same when the contractions result in muscular fatigue, at which time the mean blood pressure is the same as it is in response to sustained isometric contractions. All the available evidence points to the same mechanisms being involved, centering around the reflex of chemical origin in active muscles. There appears, however, to be considerable differences in the local control of blood vessels when isometric contractions are pursued to fatigue on a continuous or on an intermittent basis. In the present experiments we have shown that the constriction is neural in origin and that metabolites which normally inhibit that constriction are unable to migrate through the interstitial space to larger arterioles not in the direct vicinity of the contracting muscles. The performance of very short bouts of rhythmic exercise can result in dramatic reductions of isometric endurance and, to some extent, isometric strength. The functional consequences are obvious: jobs calling for either isometric strength or endurance can be seriously impaired by previous rhythmic exercise. The causes are only partially disclosed by our experiments. GRA

N84-15772# University of the Pacific, Forest Grove, Oreg. Coll. of Optometry.
EVALUATION OF FACTORS PRODUCING VISUAL EVOKED RESPONSE VARIABILITY Final Report, 1 Jun. 1982 - 31 May 1983
Robert L. Yolton Jun. 1983 41 p
(Grant AF-AFOSR-0160-82; AF Proj. 2313)
(AD-A133917; AFOSR-83-0854TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Ten steady-state visual evoked responses (VERs) were recorded from each of 47 normal, adult subjects. For each subject, the mean and standard deviation for the ten VER amplitudes were calculated and used to determine amplitude variability. While some subjects produced extremely reliable VERs, data from the majority showed a considerable degree of variability. A number of factors including trend, noise, attention, binocularity, accommodation, eye movements, artifacts and electrode placement were evaluated to determine their relative contributions to this variability. Noise and trend factors produced a large proportion of the variability (62%) while the other factors were found to be relatively insignificant.
Author (GRA)

N84-15773# New York Univ., New York.
PERCEPTION OF HIGHER DERIVATIVES OF VISUAL MOTION Interim Scientific Report, 1 Jan. - 31 Dec. 1982
Lloyd Kaufman and Samuel J. Williamson 23 Apr. 1983 5 p
(Grant AF-AFOSR-0050-82; AF Proj. 2313)
(AD-A133908; AFOSR-83-0831TR) Avail: NTIS HC A02/MF A01 CSCL 05/10

This document describes a basic experiment involving the sensitivity of the visual system to the modulation of speed of gratings moving in one direction across the visual field. The gratings were of different spatial frequencies, had different average speeds, and the speeds were modulated at different temporal frequencies. This was done in two stages using the method of adjustment. We also implemented a very sophisticated computer program allowing us to use a two-interval forced-choice paradigm in the context of a modified staircase method for accurately measuring thresholds for change of speed and how they are affected by the foregoing parameters, and others as well. Findings indicated that for all modulation frequencies, sensitivity to acceleration was uniform across all spatial frequencies at low average speeds. As average speed increased, there was an increasing monotonic increase in sensitivity for spatial frequency. Acceleration is proportional to modulation frequency as well as to the amplitude of the modulation of speed. GRA

N84-15774# Army Medical Bioengineering Research and Development Lab., Fort Detrick, Md.
NEUROBEHAVIORAL EFFECTS OF CARBON MONOXIDE (CO) EXPOSURE IN HUMANS PROTOCOL 1 Final Report, 1981 - 1982
Vernon A. Benignus, Keith E. Muller, Curtis N. Barton, James D. Prah, and Laura Love Benignus Jan. 1983 80 p
(AD-A133891) Avail: NTIS HC A05/MF A01 CSCL 05/10

The neural and behavioral effects of acute low level carbon monoxide exposure are not well known but have been reported to produce sensory and vigilance deficits. Stage one of this research program is to establish a reliable paradigm for the measurement of CO effects. During stage two concentration-effects functions are to be established. Stage three is concerned with the evaluation of the concentration effects functions in an actual field (Army training) setting. A total of 92 subjects were used in this double-blind study, 47 air-exposed controls and 45 subjects exposed to 200 ppm CO for 1.5 hours. In the confirmatory analyses CO did not affect any behavioral measure. Alpha-band EEG power may have been affected by this level and duration of CO exposure. Although the trends were subjectively reliable for each of two tasks on both EEG sites in both halves of

the sample and in the total group, the effect did not reach statistical significance. Vigilance, alpha-band EEG power and theta-band EEG power had significant trends across time. Apparently unless CO has some non-hypoxic effect, no cosistent vigilance decrement should occur until COHb reaches about 13%. There might be specific but minor effects as low as 7% COHb. Since these figures were based upon extrapolations, they are subject to considerable error. GRA

N84-15775# Virginia Mason Research Center, Seattle, Wash.
INTERACTION OF ANTI-G MEASURES AND CHEST WALL MECHANICS IN DETERMINING GAS EXCHANGE Annual Progress Report, 1 Apr. 1982 - 31 Mar. 1983
Harold I. Modell May 1983 40 p
(Contract F49620-81-C-0055; AF Proj. 2312)
(AD-A133740; AFOSR-83-0808TR) Avail: NTIS HC A03/MF A01 CSCL 06/19

Efforts during this reporting period have been directed in three areas: (1) Examination of regional intrapleural pressure changes during +Gz stress in the pig; (2) Development of an inexpensive assist/control, volume limited animal ventilator; and (3) Determining the influence of chest wall motion on gas exchange during mechanical ventilation in dogs. Studies assessing regional intrapleural pressure changes during +Gz stress in the dog were repeated in similar sized pigs to determine the role of chest wall mechanics in determining these changes. When the G-suit abdominal bladder was used, increases in regional intrapleural pressure greater than those seen in analogous dog experiments were observed. These results imply that, as the chest wall becomes less compliant, the degree of lung compression attributable to +Gz stress without G-suit application should deminish. In another series of experiments, gas exchange during assisted and controlled ventilation were compared in an attempt to ascertain whether an active effort by chest wall muscles coordinated with inspiration can influence gas exchange. The data obtained indicate that an inspiratory muscular effort enhances gas exchange. Measured gas exchange parameters suggest that this enhancement is the result of a redistribution of perfusion rather than a redistribution of ventilation. GRA

N84-15776# California Univ., Los Angeles. Mental Retardation Research Center.
NEURONAL ADAPTIVE MECHANISMS UNDERLYING INTELLIGENT INFORMATION PROCESSING Final Report
Charles D. Woody May 1983 82 p
(Grant AF-AFOSR-0179-81; AF Proj. 2312)
(AD-A133694; AFOSR-83-0834TR) Avail: NTIS HC A05/MF A01 CSCL 05/10

Acceleration of the rate of learning of a conditioned facial movement was accomplished by adding electrical stimulation of the hypothalamic region of the brain to presentations of conventional conditioned and unconditioned stimuli, confirming earlier Soviet observations of a comparable effect by such simulation. The learning that resulted was both associative and discriminative. That is, learning was induced by a specific stimulus combination, the code depending on the order and interval of presentations of two different stimuli. The learned response was then elicitable by a specific stimulus combination, the code depending on the order and specific input signal. Research indicates that the pattern of cortical neuronal activity produced by hypothalamic stimulation predicts loci of hypothalamic stimulation that, when, stimulated, will succeed in accelerating learning. Present studies are directed toward establishment of whether the hypothalamic stimulation responsible for acceleration of learning is punishing or rewarding. This may, however, be of less consequence in understanding what is going on than would specifying the coded molecular interactions that occur between the chemical(s) released by hypothalamic stimulation and other chemicals capable of modifying the transfer properties of the nerve cell. It is these interactions that are thought to be primary in controlling the potentiation of learning.
Author (GRA)

N84-15777# Naval Submarine Medical Research Lab., Groton, Conn.
PROCEEDINGS OF THE 3RD TRIPARTITE CONFERENCE ON SUBMARINE MEDICINE: FRANCE, UNITED KINGDOM AND THE UNITED STATES
Douglas R. Knight and Kenneth R. Bondi 1 Jun. 1983 190 p
(AD-A133150; NSMRL-SR-83-1) Avail: NTIS HC A09/MF A01 CSCL 06/19

The proceedings of the third triparite conference on submarine medicine are reported. Five sessions were included in the 2-day conference, namely; (1) (STANAG 1206) Maximum Concentrations of Toxic Substances during Operational Conditions; (2)(STANAG 1184) Emergency Conditions at 1 ATA--Maximum Concentrations in Conventional Submarines;(3)The Toxicology of Atmosphere Contaminants in Submarines;(4)Escape or Rescue Distressed Submarines; and (5)Effects of Lifestyles aboard Submarines on Human Performance and Function. Participants included scientists from the three nations--France, the United Kingdom and the United States. GRA

N84-15778# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
INHALATION TOXICOLOGY. 3: EVALUATION OF THERMAL DEGRADATION PRODUCTS FROM AIRCRAFT AND AUTOMOBILE ENGINE OILS, AIRCRAFT HYDRAULIC FLUID, AND MINERAL OIL
Charles R. Crane, Donald C. Sanders, Boyd R. Endecott, and John K. Abbott Apr. 1983 19 p
(AD-A133221; FAA-AM-83-12) Avail: NTIS HC A02/MF A01 CSCL 06/20

A malfunctioning seal in the gear-reduction box of a turboprop aircraft engine could allow oil to enter the turbine's compressor section, which is the source of bleed air used to pressurize the cabin. Oil, or its degradation products, could have a deleterious effect on crew and passengers. A series of tests sponsored by the National Transportation Safety Board had examined the possibility that contaminated bleed air might contain toxic products identifiable by chemical analysis, but none of the gases for which they analyzed were present in toxic concentrations. However, the approach did not eliminate the possible presence of an additional component with significant animal toxicity. The research reported here examined the toxicity of thermal degradation products from aircraft lubricating oils and some related products. Rats were exposed to smoke from these products and relative toxicity evaluated in terms of time-to-incapacitation and time-to-death. The carbon monoxide (CO) content of the smoke was measured and this information, in conjunction with the animal response times, was the basis for concluding that the decomposition of these oils did not produce any chemical species, other than CO, in quantities sufficient to contribute to the total toxicity. GRA

N84-15779# Ohio State Univ., Columbus. Research Foundation.
OPTICAL FLOW AND TEXTURE VARIABLES USEFUL IN SIMULATING SELF MOTION (2) Final Technical Report, 1 Feb. 1982 - 31 Mar. 1983
Dean H. Owen Jun. 1983 143 p
(Grant AF-AFOSR-0078-81; AF Proj. 2313)
(AD-A133597; AFOSR-83-0807TR) Avail: NTIS HC A07/MF A01 CSCL 06/16

This report outlines a program of research applying ecological optics to the study of visual information useful for detecting and guiding self motion during flight. Techniques are presented for isolating optical sources of information by controlling simulated flight path and speed variables in conjunction with ground surface texture variables. Problems encountered in the design of experiments using higher-order ratios exhibiting constrained linkages are discussed, and several solutions are suggested. A case is made for the necessity of considering the entire perception-(control) action cycle in the study of self-motion sensitivity, and implications of ecological optics experiments for the understanding of smart information-specifying visual system mechanisms are discussed.

Three experiments are presented testing the usefulness of optical variables and invariants for detecting changes in speed and altitude. Our findings to date provide a basis for the development of tests to evaluate candidates for flight training, the simulators with which pilots are trained, and improvement in sensitivity with training. In addition, our approach provides a sound empirical foundation from which to begin interactive experiments in which pilots control, rather than simply react to, the variables and invariants of optical stimulation. GRA

N84-15780# Army Research Inst. of Environmental Medicine, Natick, Mass.
HEAT EXCHANGE FOLLOWING ATROPINE INJECTION BEFORE AND AFTER HEAT ACCLIMATION
Margaret A. Kolka, William L. Holden, and Richard R. Gonzalez Aug. 1983 16 p
(DA Proj. 3M1-62734-A-875)
(AD-A132618; USARIEM-M45/83) Avail: NTIS HC A02/MF A01 CSCL 06/15

The effect of saline and atropine injection (2 mg, im) on eight healthy, male subjects before and after heat acclimation was studied while each subject did treadmill walking in a hot-dry environment. Partitional calorimetric analysis was done for the periods in which maximum sweat inhibition occurred (30 min). Mean skin temperature (T sk), rectal temperature and heart rate was continuously observed. Evaporative loss from the skin was calculated by changes in body weight (Sauter balance); heat transfer coefficients were defined by Nishi equations. A prediction of sweat inhibition based on an analysis of heat storage and its effect on a theoretical temperature which can be graphed on a psychrometric chart, was developed. A rational effective temperature (ET*) defined as the T sub 0 at the intersection of the 50% rh which emcompasses total heat exchange was used to compare the effects of atropine before and after heat acclimation. The results show that heat acclimation reduced ET* by some 2.5 C when compared to the unacclimated state after atropine injection. Thus, heat acclimation reduces the hazards of heat stroke caused by exercise in the heat with atropine injection. GRA

N84-15781# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
COLOR PERCEPTION AND ATC JOB PERFORMANCE
Evan W. Pickrel and John J. Convey Jul. 1983 20 p
(AD-A132649; FAA-AM-83-11) Avail: NTIS HC A02/MF A01 CSCL 06/14

Current OMP policy and guidance requires demonstrated job-relatedness and reasonable accommodation in the application of physical qualifications. The OPM has accomplished an analysis of the Air Traffic Control Specialist (ATCS) series and recommended development of functional color vision tests 'to reflect as closely as possible the functional color vision requirements of the specialty. If the Pseudoisochromatic plate (PIP) test is retained for prescreening to identify applicants for whom followup functional performance testing or reasonable accommodation is necessary, its use also must be standardized.' This research is directed toward accomplishment of those recommendations. Standard Pseudoisochromatic (PIP) plate test was validated against performance of ATCS tasks, and it demonstrated job relatedness and reasonable accommodation for application of physical qualification standards. A functional color vision test was created, but further development and validation would be needed before its operational use, and procurement would be very costly as compared to the standard PIP tests that are readily available to medical examiners. GRA

N84-15782# Cornell Univ., Ithaca, N.Y. School of Applied and Engineering Physics.
BASIC VISION EVENTS Phase Report, Aug. 1981 - Aug. 1982
Aaron Lewis 1 Aug. 1982 17 p
(Contract N62269-81-C-0744)
(AD-A132746; NADC-83050-60) Avail: NTIS HC A02/MF A01 CSCL 06/16

This investigation studied basic visual events in three particular areas. First, additional physical explanations for visual sensitivity at 589 nm have been obtained which suggests that there may be other monochromatic wavelengths with high visual sensitivity. Second, new femtosecond lasers have been applied to elucidate new, unresolved primary processes in visual transduction. Third, fundamental mechanisms in a unique, rapidly adjustable light filter based on molecules used in visual systems have been studied. GRA

N84-15783# Cornell Univ., Ithaca, N.Y. School of Applied and Engineering Physics.
PRIMARY EVENTS IN VISION - INVESTIGATION OF BASIC EYE RESPONSES Phase Report, Jun. 1982 - Jun. 1983
Aaron Lewis 30 Jun. 1983 13 p
(Contract N62269-82-M-3270)
(AD-A132747; NADC-83051-60) Avail: NTIS HC A02/MF A01 CSCL 06/16

The focus of this investigation is on the inter-relationship between two chemical mediators in the amplification of light in vision-calcium and cyclic GMP. Two questions were studied: whether calcium affects both the activation and deactivation of the light dependent hydrolysis of cyclic GMP by phosphodiesterase (PDE) in visual cells and the possible role of calmodulin in this activation and deactivation of PDE. GRA

N84-15784# Columbia Univ., New York. Dept. of Psychology.
SPATIAL LOCALIZATION IN STRABISMIC OBSERVERS Phase Report, 10 Jun. 1982 - 10 Jun. 1983
Leonard Matin 10 Jun. 1983 23 p
(Contract N62269-82-M-3208)
(AD-A132748; NADC-83049-60) Avail: NTIS HC A02/MF A01 CSCL 06/16

This report is an investigation of the way in which extraretinal eye position information (EEPI) is involved in the determination of localization and the possibility of flexibility and/or adaptation in the relation between the retinal image location (RI) and EEPI. GRA

N84-15785# Rochester Univ., N. Y. Dept. of Medicine.
EXPOSURE CHAMBER FOR STUDIES OF POLLUTANT GASES AND AEROSOLS IN HUMAN SUBJECTS: DESIGN CONSIDERATIONS
Mark J. Utell, Paul E. Morrow, Richard W. Hyde, and Richard M. Schreck (General Motors Research Labs., Warren, Mich.) 1983 10 p refs Presented at the Ann. Meeting of Assoc. for Aerosol Res., Munich, 13 Sep. 1983
(Contract DE-AC02-76EV-03490)
(DE84-001135; DOE/EV-03490/2335; CONF-8309167-2) Avail: NTIS HC A02/MF A01

An exposure chamber was designed and built at the University of Rochester Medical Center for studies of human volunteers exposed to gaseous and/or aerosol pollutants for periods of hours to days. The 45 cu m chamber normally operates at an air change rate of 10 cu m/min with ranges in temperatures from 100 to 31.50C and relative humidity from about 25 to 85%. Aerosols are produced by an eight-jet D-31 nebulizer, electrically neutralized and introduced into the chamber inlet air via a venturi mixer and five ceiling diffuser inlets. The aerosols can range in size from submicron to several microns and final chamber concentrations of 10 to several thousand micrograms per cubic meter can be produced having a spatial variation within the chamber of + or - 5% of the mean. The particulate environment within the chamber can be continuously monitored by a particle size analyzer and nephelometer and gas concentrations by chemical analyzers. Pollutant gases are obtained as standardized compressed gases and introduced into the chamber via the same venturi mixer. DOE

N84-15786# Research Inst. of National Defence, Umea (Sweden). Dept. 4.
DOSE CONVERSION FACTORS FOR INHALED RADIONUCLIDES
Leif Svensson Oct. 1983 245 p refs
(Contract SSI/P103)

(FOA-C-40184-A3; ISSN-0347-2124) Avail: NTIS HC A11/MF A01

Dose conversion factors for internal dosimetry were computed and tabulated for inhaled radionuclides, using the International Commission on Radiological Protection task group inhalation model. Computed dose conversion factors relate absorbed dose in human tissue to inhaled activity with the time of integration as parameter. Tabulated dose conversion factors include contributions from naturally occurring and manmade radionuclides such as activation products, fission products and actinides.

Author (ESA)

N84-15787# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

MEDICAL ASPECTS OF SURVIVAL: TRAINING FOR AIRCREW

T. Verheij Jun. 1983 23 p refs In FRENCH English version document was announced as N83-22999

(AGARD-AG-283(Fr); AGARD-AG-283(Eng); ISBN-92-835-1442-4) Avail: NTIS HC A02/MF A01

Maintenance of health, medical aid to survivors, general management of injuries, heat and cold exposure, specific injuries, survival illnesses, and medical aspects of escape and evasion are discussed.

Author

N84-15788# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

SLEEP AND WAKEFULNESS HANDBOOK FOR FLIGHT MEDICAL OFFICERS

A. N. Nicholson (Inst. of Aviation Medicine, Farnborough, England) and Barbara M. Stone (Inst. of Aviation Medicine, Farnborough, England) Nov. 1983 103 p In FRENCH Previously announced as N82-27972

(AGARD-AG-270(FR)) Avail: NTIS HC A06/MF A01

Sleep and wakefulness related to aircrew and the aviation environment are discussed. Eight topics are covered: alertness and sleep, sleep, Circadian rhythms, shiftwork, transmeridian flight, air operations and irregularity of work, disorders of sleep and arousal, and hypnotics.

N.W.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N84-15789*# National Aeronautics and Space Administration, Washington, D. C.

A STUDY ON AIRBORNE INTEGRATED DISPLAY SYSTEM AND HUMAN INFORMATION PROCESSING

K. Mizumoto, H. Iwamoto, S. Shimizu, and I. Kuroda Sep. 1983 19 p refs Transl. into ENGLISH from Japan Air Self Defence Force, Aeromedical Lab. Reports (Japan), v. 23, no. 3, Sep. 1982 p 77-88 Original language document was announced as A83-26086 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3541)

(NASA-TM-77338; NAS 1.15:77338) Avail: NTIS HC A02/MF A01 CSCL 05I

The cognitive behavior of pilots was examined in an experiment involving mock ups of an eight display electronic attitude direction indicator for an airborne integrated display. Displays were presented in digital, analog digital, and analog format to experienced pilots. Two tests were run, one involving the speed of memorization in a single exposure and the other comprising two five second exposures spaced 30 sec apart. Errors increased with the speed of memorization. Generally, the analog information was assimilated faster than the digital data, with regard to the response speed. Information processing was quantified as 25 bits for the first five second exposure and 15 bits during the second.

D.H.K. (IAA)

N84-15790# Hawaii Univ., Manoa.

INFLUENCES ON GROUP PRODUCTIVITY. 2: FACTORS INHERENT IN THE PERSON. A BIBLIOGRAPHIC SYNOPSIS Interim Report

Sheryl Osato, Peter E. Campos, Neal Goodman (St. Peters College), and Dan Landis (Indiana Univ. - Purdue Univ.) 15 Jul. 1983 62 p refs

(Contract N00014-83-K-0021)

(AD-A131015; CARE-83-3) Avail: NTIS HC A04/MF A01 CSCL 05/10

The present summary examines the effects of heterogeneity on a group's productivity. Heterogeneity has been defined on many different dimensions without much consistency between workers. For the sake of clarity, we have grouped the studies by the type of variable used to define heterogeneity: personality variables or sociodemographic variables. In all the studies surveyed, these different variables have served as the independent dimension.

GRA

N84-15791# Educational Testing Service, Princeton, N. J.

COMPARISON OF IRT OBSERVED-SCORE AND TRUE-SCORE EQUATINGS

Frederic M. Lord and Marilyn S. Wingersky Jul. 1983 14 p

(Contract N00014-80-C-0402)

(AD-A133871; ETS-RR-83-26-ONR) Avail: NTIS HC A02/MF A01 CSCL 05/10

Two methods of 'equating' tests using item response theory are compared, one using true scores, the other using estimated observed scores. On the data studied, they yield almost indistinguishable results. This is a reassuring result for users of IRT equating methods.

Author (GRA)

N84-15792# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence lab. LAB

VISUAL ROUTINES

Shimon Ullman Jun. 1983 68 p

(Contract N00014-80-C-0505; Grant NSF MCS-79-23110)

(AD-A133634; AI-M-723) Avail: NTIS HC A04/MF A01 CSCL 05/10

This paper examines the processing of visual information beyond the creation of the early representations. A fundamental requirement at this level is the capacity to establish visually abstract shape properties and spatial relations. This capacity plays a major role in object recognition, visually guided manipulation, and more abstract visual thinking. The proficiency of the human system in analyzing spatial information far surpasses the capacities of current artificial systems. The study of the computations that underlie this competence may therefore lead to the development of new more efficient processors for the spatial analysis of visual information. It is suggested that the perception of spatial relations is achieved by the application to the base representations of visual routines that are composed of sequences of elemental operations. Routines for different properties and relations share elemental operations. Using a fixed set of basic operations, the visual system can assemble different routines to extract an unbounded variety of shape properties and spatial relations. A number of plausible basic operations are suggested, based primarily on their potential usefulness, and supported in part by empirical evidence. The operations discussed include shifting of the processing focus, indexing to an odd-man-out location, bounded activation, boundary tracing, and marking. The problem of assembling such elemental operations into meaningful visual routines is discussed briefly.

GRA

N84-15793# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

JOB ATTITUDES TOWARD THE NEW MAINTENANCE CONCEPT OF THE AIRWAY FACILITIES SERVICE

David J. Schroeder and Julia R. Deloney Feb. 1983 82 p

(AD-A133282; FAA-AM-83-7) Avail: NTIS HC A05/MF A01 CSCL 05/9

To determine the attitudes of Airway FacilitieS (AF) personnel to the proposed New Maintenance Concept (NMC), an extensive

questionnaire was mailed to all employees. Of 11,569 questionnaires distributed, 6,976 were completed and returned. Responses to the NMC questions were analyzed with respect to employee characteristics, job satisfaction measures, shift work, and general health variables. This report summarizes the findings from the NMC questionnaire and provides a technical documentation of the completed study. However, regular consultation with Airway Facilities Service (AAF) officials was conducted throughout the data analyses period for use in management decisions regarding this developing concept. Also, although the functions of AAF were formally assumed by the Systems Engineering Service (AES) and Program Engineering and Maintenance Service (APM) in a reorganization effective October 4, 1982, the older designation (AAF) will be used throughout this report. GRA

N84-15794# Ben Gurion Univ. of the Negev, Beersheva (Israel). Dept. of Behavioral Sciences.
A COMPARISON OF MAP LEARNING METHODS: MAP STUDY, SIMULATED TRAVEL AND MIXED Final Report, 15 Sep. 1981 - 14 Mar. 1983
David Leiser 1 Jun. 1983 42 p Presented at Israel Ergonomics Soc. Conf., 1983
(Grant AF-AFOSR-0244-81; AF Proj. 2301)
(AD-A133544; EOARD-TR-83-14) Avail: NTIS HC A03/MF A01 CSCL 08/2

Two main methods of studying spatial networks were compared: travel in the network, using a computer simulation, and study of a map of the network. Subjects were tested on their ability to demonstrate efficient routes between points on the network, using the same computer simulation. Study times, efficiency of the routes and time characteristics of the performance were recorded. Findings include: latency before beginning a simulated travel increases with the origin-goal distance in map condition, but not in travel condition. In travel, latencies are shorted, but study times longer than with the map method. Variants of the basic methods were also studied. It was concluded that variations in the study methods affect study time and performance characteristics. Innovative study methods may produce significant improvement in the performance, especially if care is taken to match study method, spatial task required, and individual characteristics. GRA

N84-15795# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
RATE OF INITIAL RECOVERY AND SUBSEQUENT RADAR MONITORING PERFORMANCE FOLLOWING A SIMULATED EMERGENCY INVOLVING STARTLE
Richard I. Thackray and R. Mark Touchstone Sep. 1983 22 p
(AD-A133602; FAA-AM-83-13) Avail: NTIS HC A02/MF A01 CSCL 05/10

The present study employed auditory startle to simulate the principal components (unexpectedness, fear, and physiological arousal) that are common to many types of sudden emergencies and compared performance recovery following startle with recovery following a nonstartling stimulus. The subject's primary task was to monitor a simulated air traffic control radar display. Performance recovery following the emergency (a radar failure signaled by either a loud or low level noise) was assessed in terms of response time and error rate on a secondary information processing (serial reaction) task and also in terms of subsequent performance on the radar monitoring task. Although the high intensity noise was clearly startling, while subjects exposed to the lower intensity noise showed only a surprise reaction, subsequent performance of the two noise exposure groups differed significantly in only two respects: The variance of initial response times was greater in the startled group, and this group had a higher frequency of incorrect responses on the serial reaction task during the first minute following stimulation. A comparison of these findings with those of other studies of simulated emergencies suggests that recovery time for simple perceptual-motor responses during the initial shock phase of an emergency is quite rapid (on the order of 1 to 3 s), and this appears to be independent of whether or not the emergency is startling and emotionally arousing or simply surprising and unexpected. If the shock phase evokes heightened emotional-physiological arousal as in the case of startle, information-processing ability may be impaired for approximately 30 to 60 s following the stimulus event. GRA

N84-15796# Army Training Development Inst., Fort Monroe, Va.
EVALUATION RESULTS FOR THE INTERACTIVE VIDEO COMPETENCY RECOGNITION SYSTEM Final Report, Dec. 1982 - Mar. 1983
Roy Avant, Carol A. Johnson, and Paul Best 30 May 1983 114 p
(AD-A133052; TDI-TR-83-4) Avail: NTIS HC A06/MF A01 CSCL 05/9

The Organizational Effectiveness Center and School (OEC/S) at Ft Ord, CA, has been the training center for the Army's Organizational Effectiveness Consultants since 1975. The effectiveness of such consultants appears to be dependent upon soft skills interpersonal competencies, rather than specific tasks which are performed. In 1979, OEC/S and the Army Research Institute contracted with McBer and Co. to develop a model of the competencies which distinguish the superior from the average consultant. Eighteen of the 33 competencies identified in the McBer model were considered by OEC/S to be potentially trainable in the course. The success of the training requires an understanding of the competencies and an ability, on the part of the trainers, to recognize if and when the competencies are being demonstrated. Author (GRA)

N84-15797# Office of Naval Research, London (England).
APPLIED PSYCHOLOGY IN EUROPE: AN ONR PERSPECTIVE Assessment Report
N. A. Bond, Jr. 27 Jul. 1983 9 p
(AD-A133093; ONRL-R-7-83) Avail: NTIS HC A02/MF A01 CSCL 05/10

This report is intended to alert American researchers to European developments in applied psychology. The following areas are examined: interactive man-machine interfaces, combat reactions and stress, memory enhancement, large digital simulators, and human performance models. GRA

N84-15798# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
HUMAN VISUAL INFORMATION PROCESSING: BASIC VIEWPOINTS FROM PSYCHOLOGY AND HUMAN ENGINEERING RESEARCH
R. C. Vandegraaff and P. H. Wewerinke 14 Jun. 1982 15 p refs Presented at 2nd European Conf. on Human Decision Making and Manual Control, Bonn, 2-4 Jun. 1982 Revised
(NLR-MP-82032-U) Avail: NTIS HC A02/MF A01

The constructivist-cognitive approach and human engineering model approach to human visual perception are compared. A multivariable decision making experiment on the engineering model is summarized. Psychological models hypothesize that conceptual knowledge determines the perceptual experience, or that perception is directly dictated by visual stimuli. The human engineering approach is that the information processing involves estimation of the environment which has to be perceived. The momentary perceived environment is compared with an expectation of its state (which has to be generated by the observer). The outcome of the comparison is the essential information (innovation), used for further processing. Engineering model predictions of detection of abnormal operation of a dynamic process agree closely with measurements ($r = 0.86$). Author (ESA)

N84-15099# Vliegbasis Volkel (Netherlands).
PHYSIOLOGICAL AND PSYCHOLOGICAL ASPECTS OF THE PILOTING OF MODERN HIGH-PERFORMANCE COMBAT AIRCRAFT
J. C. F. Aghina *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 3 p (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N84-15799# Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.
ROBOTICS-RELATED TECHNOLOGY IN THE NUCLEAR INDUSTRY
W. R. Hamel and H. L. Martin 1983 15 p refs Presented at the 27th Ann. Intern. Tech. Symp. on High Speed Photography, Videography and Photonics, San Diego, Calif., 23 Aug. 1983
(Contract W-7405-eng-26)
(DE83-017131; CONF-830874-22) Avail: NTIS HC A02

Similarities between teleoperators and robots are reviewed. Applications and development activities in teleoperated systems are summarized on a worldwide basis. Teleoperator developments are examined for outer space, under water, and other hazardous environments. The unification of a robot and a teleoperator system into an autonomous, flexible machine is envisioned as the goal of future telerobotic research. DOE

N84-15800# Office of Naval Research, London (England).
ROBOT MANIPULATOR CONTROL
J. P. Blackburn 7 Mar. 1983 15 p refs
(AD-A129365; R-1-83) Avail: NTIS HC A02/MF A01 CSCL 05/8

A synthetic approach for calculating the control of robot manipulators is given. The initial control problem is broken down into linear control and modelling problems. The approach allows derivation of numerous schemes (adaptive or not) of control proposed in the literature and suggests new schemes. It is shown that the problem of modeling is difficult but is less crucial if one can synthesize robust controls that are not sensitive to errors of modelling. GRA

N84-15801# Army Research Inst. of Environmental Medicine, Natick, Mass.
EFFECTIVENESS OF TWO PORTABLE LIQUID-COOLED UNDERGARMENTS IN REDUCING HEAT STRESS
George F. Fonseca Apr. 1983 22 p
(DA Proj. 3E1-62777-A-878)
(AD-A133174; USARIEM-T-3/83) Avail: NTIS HC A02/MF A01 CSCL 06/17

The auxiliary cooling provided by each of two portable liquid-cooled undergarments was directly measured on a life-sized sectional manikin. One undergarment (LCU 1) provided cooling over the torso area; the other (LCU 2) provided cooling over the torso and head areas. The liquid contained in both undergarments was cooled by circulating it through an ice-filled compartment (i.e., a heat exchanger). This manikin was dressed in a complete chemical protective (CW) suit in MOPP 4 configuration. Cooling rates (watts) were determined versus time for a completely wet (maximal sweating) skin condition during exposure to two hot environments. In a chamber environment of 45 deg C, the average torso cooling rate over the first hour for LCU 1 is about 94 watts which decreases to about 46 watts over the second hour of cooling; for LCU 2 the average torso and head cooling rates were 81 watts and 67 watts, over the first and second hours, respectively. Only about 20 watts of cooling was still being provided over the third hour of cooling by either portable liquid-cooled undergarment. GRA

N84-15802# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
A DISTRIBUTED CONTROL SYSTEM FOR THE CMU ROVER Progress Report
Alberto Elfes and Sarosh N. Talukdar 27 Jan. 1983 10 p Sponsored in part by Conselho Nacional de Desenvolvimento Cientifico e Technologico and Instituto Technologico de Aeronautica
(Contract N00014-81-K-0503)
(AD-A133201; AD-E000546) Avail: NTIS HC A02/MF A01 CSCL 06/4

This paper describes a distributed control structure developed for the CMU Rover, an advanced mobile robot equipped with a variety of sensors. Expert modules are used to control the operation of the sensors and actuators, interpret incoming data, build an internal model of the robot's environment, devise strategies to accomplish proposed tasks and execute these strategies. Each expert module is composed of a master process and a slave process, where the master process controls the scheduling and working of the slave process. Communication among expert modules occurs asynchronously with the aid of a blackboard. Information specific to the execution of a given task is provided through a control plan. The system is distributed over a network of processors. Operating system kernels local to each processor and an interprocess message communication mechanism ensure transparency of the underlying network structure. The various parts of the system are presented in this paper and future work to be performed is mentioned. Author (GRA)

N84-15803*# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
THE STANFORD CART AND THE CMU ROVER
Hans P. Moravec 24 Feb. 1983 40 p Sponsored in part by NASA and Defense Advanced Research Projects Agency and National Science Foundation
(Contract N00014-81-K-0503)
(NASA-CR-174502; NAS 1.26:174502; AD-A133207; AD-E000546) Avail: NTIS HC A03/MF A01 CSCL 06D

The Stanford Cart was a remotely controlled TV equipped mobile robot. A computer program was written which drove the Cart through cluttered spaces, gaining its knowledge of the world entirely from images broadcast by an onboard TV system. The CMU Rover is a more capable, and nearly operational, robot being built to develop and extend the Stanford work and to explore new directions. The Cart used several kinds of stereopsis to locate objects around it in 3D and to deduce its own motion. It planned an obstacle avoiding path to a desired destination on the basis of a model built with this information. The plan changed as the Cart perceived new obstacles on its journey. The system was reliable for short runs, but slow. The Cart moved one meter every 10 to 15 minutes, in lurches. After rolling a meter it stopped, took some pictures and thought about them for a long time. Then it planned a new path, executed a little of it, and paused again. It successfully drove the Cart through several 20 meter courses (each taking about 5 hours) complex enough to necessitate three or four avoiding swerves; it failed in other trials in revealing ways. The Rover system has been designed with maximum mechanical and control system flexibility to support a wide range of research in perception and control. It features an omnidirectional steering system, a dozen onboard processors for essential real time tasks, and a large remote computer to be helped by a high speed digitizing/data playback unit and a high performance array processor. Distributed high level control software similar in organization to the Hearsay II speech understanding system and the beginnings of a vision library are being readied. GRA

N84-15804# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
POPEYE: A GRAY-LEVEL VISION SYSTEM FOR ROBOTICS APPLICATIONS Interim Report
Rafael Bracho, John F. Schlag, and Arthur C. Sanderson 4 May 1983 40 p
(Grant NSF ECS-79-23893)
(AD-A133298; CMU-RI-TR-83-6) Avail: NTIS HC A03/MF A01 CSCL 09/2

A gray-level image processing system has been constructed to provide capability for inspection, object orientation, object classification,and interactive control tasks in an inexpensive, stand-alone system with moderate processing speed. The POPEYE system offers a range of functions including algorithms for preprocessing, feature extraction, image modeling, focusing,

automatic pan, tilt, and zoom, interactive communication with other devices, and convenient user interaction. The host processor is a Motorola 68000 processor with Multibus communication between principal modules, an image data bus for acquisition and storage and a pipeline bus for image preprocessing and programmable transform operations. The software structure provides hierarchical control over multiple i/o devices, file management of system storage, an image management package and a vector package. Performance of the system is evaluated using convolution filters, adaptive modeling, histogram modification, and connectivity analysis. Cellular logic operations, piecewise gradient segmentation, automatic focusing, and adaptive spatial filtering examples are described in detail. The system is being applied to a number of practical industrial applications. Author (GRA)

N84-15805# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
THE HUMAN SIDE OF ROBOTICS: RESULTS FROM A PROTOTYPE STUDY ON HOW WORKERS REACT TO A ROBOT Interim Report
Linda Argote, Paul S. Goodman, and David Schkade May 1983 28 p
(AD-A133438; AD-E750844; CMU-RI-TR-83-11) Avail: NTIS HC A03/MF A01 CSCL 06/4

This study examines workers' reactions to the introduction of robots in a factory. The study focuses on understanding workers' psychological reactions to this new technology and to the manner in which it was introduced. Workers reported that both advantages (lower fatigue) and disadvantages (increased downtime) were associated with the introduction of the robot. Over time, workers' beliefs about robots became more complex and pessimistic. Production operators' jobs, as well as their interaction patterns with other production and support workers changed with the introduction of the robot. Consequences of these changes for increases in job stress are examined. A set of strategies for introducing robots in the factory is discussed. Author (GRA)

N84-15806# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
APPROPRIATE LENGTHS BETWEEN PHALANGES OF MULTI-JOINTED FINGERS FOR STABLE GRASPING Interim Report
Tokuji Okada and Takeo Kanade 22 Jul. 1983 20 p
(AD-A133448; CMU-RI-TR-83-13) Avail: NTIS HC A02/MF A01 CSCL 06/4

An appropriate arrangement of finger joints is very important since the stability of grasping an object greatly depends on that arrangement. Multijointed fingers can grasp an object with many points of contact each of which is pressed against the object as if wrapping up that object. The amount of the wrapped up area and the form of the finger when an object is grasped are therefore important factors for determining the stability of grasping. The authors propose the wrapping factor to be used for the evaluation of the stability of grasping by using these factors. They consider twenty eight models for the finger having three joints, and perform a simulation of their ability to grasp various shapes stably. Based on the simulation results, an appropriate arrangement of lengths between phalanges for a multijointed finger is presented. GRA

N84-15807# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
IMPLEMENTATION OF AUTOMATIC FOCUSING ALGORITHMS FOR A COMPUTER VISION SYSTEM WITH CAMERA CONTROL Interim Report
John F. Schlag, Arthur C. Sanderson, Charles P. Neuman, and Francis C. Wimberly 15 Aug. 1983 90 p Sponsored in part by Navy and Westinghouse Electric Corp.
(AD-A133492; CMU-RI-TR-83-14) Avail: NTIS HC A05/MF A01 CSCL 09/2

The POPEYE system is a grey level computer vision system developed for research and development. It provides a convenient environment for research by coupling a powerful microprocessor with a large base of support software. The particulars of the system's hardware configuration and software support are given after an explanation of the desires which motivated its fabrication. In addition to providing general computation and display capabilities, the system provides open loop manual or software control over the camera parameters of pan, tilt, focus, and zoom. This offers many advantages over fixed arrangements such as the ability to investigate focusing and elementary tracking algorithms. This work describes the implementation of several standard automatic focusing algorithms on the POPEYE system and provides experimental evaluation and comparison. This leaves the system with a valuable enhancement and provides a starting point for the implementation of a production focusing system. There are many possible uses for such a system, including robotic assembly and inspection tasks. One application is the development of industrial inspection algorithms for the Factory of the Future Project. Part of this project involved the inspection of fluorescent lamp mount assemblies. Algorithms for the automated inspection of the assemblies are described which represent the solutions to difficult inspection problems currently beyond the capabilities of commercial vision systems. Suggestions for the implementation of a production focusing system are given alone with suggestions for possible hardware improvements to the POPEYE system. GRA

N84-15808# Human Performance Research, Inc., Goleta, Calif.
COMPUTER BASED LANDING SIGNAL OFFICER CARRIER AIRCRAFT RECOVERY MODEL Final Report, Oct. 1977 - Jul. 1980
Michael E. McCauley and Gail J. Borden Sep. 1983 70 p
(Contract N61339-77-C-0110)
(AD-A133507; HPR-101; NAVTRAEQUIPC-77-C-0110-1) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report describes a two phase research effort to develop a two phase Landing Signal Officer (LSO) decision-making model to serve as a performance criterion in an automated training system. In the first of the two-phase development effort, analytic methods including observations, interviews, conferences and literature reviews were used to collect data concerning the LSO functions and decision-making processes during carrier aircraft recovery operations. GRA

N84-15809# University of Southern California, Redondo Beach. Behavioral Technology Labs.
A PERFORMANCE-BASED TECHNIQUE FOR ASSESSING EQUIPMENT MAINTAINABILITY Final Report
Douglas M. Towne, Mark C. Johnson, and William H. Corwin Aug. 1983 61 p
(Contract N00014-80-C-0493; NR Proj. 196-165)
(AD-A133518; TR-102) Avail: NTIS HC A04/MF A01 CSCL 15/5

Previous research produced a computer-implemented model of corrective maintenance performance, based on a relatively simple maximum-productivity rule for selecting maintenance operations, and a relatively complex data base representing particular systems. The model has been expanded to recognize the impact of task-sequence context upon the actions necessary to accomplish tasks. Decisions at each stage of a simulated maintenance requirements now reflect the effects of previously performed work on the time and effort necessary to perform future tasks. Maintainability projections were generated for a digital infrared transmitter/receiver system, specially constructed to be configured in two functionally equivalent forms. Ten electronics technicians worked to identify and resolve eight inserted malfunctions each, using built-in indicators and standard test equipment. The overall projections of maintenance times compared well to the experimental data. A measure of design complexity is proposed for the evaluation of maintainability. This measure, mean number of indicators necessary to accomplish fault isolation, is sensitive to multiplicity of fault modes and to the extent to which fault symptoms are confounded at the maintainer interface. GRA

N84-15810# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
LABORATORY ROBOTICS AT THE SAVANNAH RIVER LABORATORY
Gregory M. Dyches and Syderis D. Burkett 1983 28 p refs

Presented at the Eastern Anal. Symp., New York, 16-18 Nov. 1983 Submitted for publication
(Contract DE-AC09-76SR-00001)
(DE84-001760; DP-MS-83-43; CONF-831198-1) Avail: NTIS HC A03/MF A01

Many analytical chemistry methods normally used at the Savannah River site require repetitive procedures and handling of radioactive and other hazardous solutions. Robotics is being investigated as method of reducing personnel fatigue and radiation exposure and also increasing product quality. Several applications of various commercially available robot systems are discussed involving cold (nonradioactive) and hot (radioactive) sample preparations and glovebox waste removal. Problems encountered in robot programming, parts fixturing, design of special robot hands and other support equipment, glovebox operation, and operator-system interaction are discussed. A typical robot system cost analysis for one application is given. DOE

N84-15056# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Avionics Dept.
THE LOCK-ON-BEFORE-LAUNCH WEAPON DELIVERY AND DISPLAY/CONTROL CONSIDERATION
Klaus Boecking *In* AGARD Advanced Concepts for Avionics/ Weapon System Design, Develop. and Integration Oct. 1983 15 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-15096# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
THE MAN-MACHINE INTERFACE IN NEW GENERATION COMMERCIAL AIRCRAFT [L'INTERFACE HOMME - MACHINE DANS LES AVIONS COMMERCIAUX DE LA NOUVELLE GENERATION]
Robert Galan *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 11 p In FRENCH (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-15102*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PILOT HUMAN FACTORS IN STALL/SPIN ACCIDENTS OF SUPERSONIC FIGHTER AIRCRAFT
Seth B. Anderson, Einar K. Enevoldson (NASA Dryden Flight Research Facility), and Luat T. Nguyen (NASA Langley Research Center) *In* AGARD Flight Mech. and System Design Lessons from Operational Experience Oct. 1983 10 p refs Document previously announced as N83-26856 (For primary document see N84-15076 06-01)
Avail: NTIS HC A15/MF A01

N84-16051*# Kansas Univ., Lawrence. Dept. of Electrical Engineering.
COMPUTER CONTROL OF A SEVEN DEGREE OF FREEDOM MANIPULATOR ARM
John Stensby *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 33 p (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 08H

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N84-15811*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATUS OF RESEARCH AT THE INSTITUTE FOR COMPUTER APPLICATIONS IN SCIENCE AND ENGINEERING (ICASE) Final Semiannual Report, 4 Oct. 1982 - 31 Mar. 1983
Nov. 1983 32 p
(Contracts NAS1-15810; NAS1-16394; NAS1-14101; NAS1-14472; NAS1-17070; NAS1-17130)
(NASA-CR-172267; NAS 1.26:172267) Avail: NTIS HC A03/MF A01 CSCL 12A

Research conducted at the Institute for Computer Applications in Science and Engineering in applied mathematics, numerical analysis and computer science is summarized. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N84-15812# Maryland Univ., College Park. Center for Automation Research.
ANALYSIS OF DATA FLOW FOR SIMD (SINGLE INSTRUCTION MULTIPLE DATA) SYSTEMS
Reinhard Klette Mar. 1983 70 p
(Grant AF-AFOSR-3271-77; Proj. 2304)
(AD-A133248; CAR-TR-1; CS-TR-1257; AFOSR-83-0782TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

Starting with an exact definition of classes of SIMD (single instruction, multiple data) systems, a general approach to obtaining lower time bounds by data flow analysis is presented. Several interconnection schemes, such as the square net, the perfect shuffle, the infinite binary tree, etc. are analyzed with respect to their data transfer possibilities. For some types of computational problems the data dependencies are analyzed in a quantitative way. From both types of analysis, lower time bounds result for many combinations of SIMD systems and computational problems, for example, omega(log N) for on-line quadtree-net systems and the computation of Voronoi diagrams for N planar points, omega(N) for off-line diagonal-net systems and the two-dimensional discrete Fourier transform, and omega(square root of N) for off- or on-line Illiac-net systems and sorting of N items.
Author (GRA)

N84-15813# Yale Univ., New Haven, Conn. Dept. of Computer Science.
CLASSIFYING BUGS IS A TRICKY BUSINESS
W. Lewis Johnson, Stephen Draper, and Elliot Soloway Aug. 1983 29 p
(Contract N00014-82-K-0714)
(AD-A133264; YALE-U/CSD/RR-284) Avail: NTIS HC A03/MF A01 CSCL 09/2

In order to build a computer-based programming tutor for novice programmers, it was necessary to first classify the bugs found in their programs on the basis of type and frequency. However, the enterprise of classification turns out to be a complicated process. While one may want to be able to simply use features in the program itself as the basis for the classification, it turns out that such a scheme will result in classifications that seem to miss the mark, i.e., the classifications will not tell you what misconception the programmer was operating under which caused the bug. To remedy this situation the authors that the programming plans that the programmer intended to use should be the basis for a classification scheme. Thus, a bug classification must take the programmer directly into account. In this paper, they compare several different methods of bug classification currently being used in software engineering projects, and show their weaknesses; while their method of using intended programming plans is not without problems, it is argued that it presents a better alternative than the other methods currently being employed. Author (GRA)

N84-15814# Carnegie-Mellon Univ., Pittsburgh, Pa. Lab. for Intelligent Systems.
TECHNIQUES FOR SENSOR-BASED DIAGNOSIS Interim Report
Mark S. Fox, Simon Lowenfeld, and Pamela Kleinosky 14 May 1983 16 p Presented at the Intern. Joint Conf. on Artificial Intelligence, Karlsruhe, West Germany, Aug. 1983 Prepared in cooperation with Westinghouse Electric Corp., Pittsburgh, Pa.
(AD-A133297; CMU-RI-TR-83-7) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper describes a system called PDS, a forward chaining, rule-based architecture designed for the online, realtime diagnosis of machine processes. Two issues arise in the application of expert systems to the analysis of sensor-based data: spurious readings and sensor degradation. PDS implements techniques called retrospective analysis and meta-diagnosis as solutions to these problems. These techniques and our experiences in knowledge acquisition in a large organization, and the implementation of PDS as a portable diagnostic tool are described.
Author (GRA)

N84-15815# Michigan State Univ., East Lansing. Dept. of Chemistry.
A MODULAR TWIN BUS MICROPROCESSOR SYSTEM FOR LABORATORY AUTOMATION
Bruce H. Newcome and Christie G. Enke 15 Sep. 1983 30 p
(Contract N00014-76-C-1092)
(AD-A133372; TR-14) Avail: NTIS HC A03/MF A01 CSCL 09/2

This modular microprocessor system can be used to create a wide range of custom-tailored computer systems out of a standard set of active modules. New modules can be easily incorporated into the system as the requirements of the instrumentation change and as improved integrated circuits become available. A unique feature of this system is the existence of two sets of bus traces on the mother board. The second bus can be used as an extension of the system bus, an interprocessor bus in a distributed processing system, a hardware driven peripheral bus, or the system bus of a second microprocessor. The second bus is shown to add substantially to the versatility and power of the system. The second bus also provides the means by which a single processor system can be upgraded into a distributor processor network without obsoleting the special interfaces designed for the single processor.
Author (GRA)

N84-15816# Gaertner (W. W.) Research, Inc., Stamford, Conn.
MULTISPECTRAL DATA PROCESSING SYSTEM (MDPS) Final Technical Report, 15 Dec. 1980 - 31 Dec. 1982
Mar. 1983 61 p
(Contract F30602-81-C-0035; AF Proj. 3205)
(AD-A133426; RADC-TR-83-60) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report summarizes the research performed in the design and specification of the computer system architecture and software required for the Multispectral Data Processing System (MDPS). The objective of the MDPS is the efficient processing of large volumes of digital bathymetric data (collected by remote multispectral sensor) representing depths and bottom features of shallow water coastal areas, navigable channels and bays, and offshore shallow reefs. The MDPS inoludes the data recording and processing portions of an airborne active/passive bathymetric system which can be used by the Defense Mapping Agency for the production and maintenance of navigation charts. Also discussed are Hardware and Software Requirements; Cost Analysis; and Error Analysis.
GRA

N84-15817# Anacapa Sciences, Inc., Santa Barbara, Calif.
DISPLAYING COLORS OF SPECIFIED CHROMINANCE ON A COLOR GRAPHICS DISPLAY
James C. Gutmann and Steven P. Rogers Dec. 1982 54 p
(Contract DAAK80-81-C-0089)
(AD-A133591; AS-TR-459-4; DAVAA-TR-81-0089-4) Avail: NTIS HC A04/MF A01 CSCL 09/2

A technique for displaying colors of specified chrominance is reviewed. The technique makes use of models of the bits-to-luminance transfer function of the phosphors of a color graphics system CRT. Measurements of the transfer function of a graphics system were made. Second order polynomial models were found to provide a good fit of the bits-to-luminance relationship. A two-part model or spliced fit approach yielded the most accurate predictions of luminance. The algebraic basis of the technique is reviewed as are the limitations of the technique. Example solutions for graphics system inputs yielding colors of specified chrominance are provided. The technique provides a method for control of color mixing and for quantitative specification of colors. The incorporation of models of the bits-to-luminance transfer function simplified the procedure used to solve for color graphics system bit values. The technique developed need not be limited to use with color CRTs. Once the input-to-luminance output relationship of any display has been measured and characterized, and once the color coordinates of the system's primaries are known, the technique for determining system inputs can be applied. The only restriction is that the CIE color coordinates of the display system color mixing primaries must not vary as a function of luminance output.
Author (GRA)

N84-15818# California Univ., Livermore. Lawrence Livermore Lab.
EFFICIENT LARGE-SCALE FINITE-ELEMENT COMPUTATIONS IN A CRAY ENVIRONMENT
G. L. Goudreau, R. A. Bailey, J. O. Hallquist, R. C. Murray, and S. J. Sackett Jun. 1983 15 p refs Presented at ASME Winter Ann. Meeting, Boston, 13 Nov. 1983
(Contract W-7405-eng-48)
(DE83-014946; UCRL-89385; CONF-831111-5) Avail: NTIS HC A02/MF A01

The Lawrence Livermore National Laboratory engineering computational experience on the CRAY-1 is highlighted in the context of some large general purpose solid and structural mechanics codes. The DYNA2D and DYNA3D are explicit large deformation inelastic Lagrangian codes with one point elements and hourglass control. The NIKE2D and NIKE3D are implicit codes of comparable continuum formulation but use two point constant pressure elements and an optimized linear equation solver. The NIKE3D has a finite rotation plastic resultant shell element. The general purpose linear elastic structures code GEMINI is also illustrated for large static and eigenvalue analysis.
DOE

N84-15819# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
THE CREATION OF THE NLR BENCHMARK PACKAGE AND THE PERFORMANCE OF TWO NEW CDC COMUTERS WITH IT
G. J. Hameetman 23 Apr. 1983 10 p Presented at VIM/ECODU Meeting, Minneapolis, 26-30 Apr. 1982
(NLR-MP-82015-U) Avail: NTIS HC A02/MF A01

Benchmarks for computing power verification, representative batch load, and interactive load were generated in order to assess Cyber 170-855 and 835 computers for aerospace research. The benchmark was also executed on a CDC 170-750. The Cyber 170-855 performs better than the 170-750. Due to its faster preprocessors and memory extension possibilities, the 170-855 has the larger growth potential. The 170-855 meets initial requirements, but growth potential requirements can only be met with a faster central processing unit (CPU), or a second CPU. For computing speed requirements, a faster CPU is needed.
Author (ESA)

N84-15820# National Bureau of Standards, Washington, D.C.
COMPUTER SCIENCE AND TECHNOLOGY: FUTURE INFORMATION PROCESSING TECHNOLOGY, 1983 Final Report
Peg Kay, ed. and Patricia Powell, ed. Aug. 1983 246 p refs Prepared in cooperation with Aurora Associates, Inc., Washington, D.C., Little (Arthur D.), Inc., Cambridge, Mass, International Data Corporation, McLean, Va., and Kellogg Communication Corp., Littleton, Colo.
(Contract NB80-SBCA-0450)

(PB83-257618; NBS-SP-500-103; LC-83-600563) Avail: NTIS HC A11/MF A01 CSCL 09B

The document contains the 1983 Technical Forecast for the information processing industry through 1997. It consists of six parts. Part I forecasts the underlying technologies of hardware and software, contains a discussion of changes in the information industry and market, and forecasts products and systems of the future, e.g., general-purpose systems, distributed processing systems, office systems. Part II contains Federal agency staff comments on Part I. Part III summarizes a teleconference in which a number of industry ADP users and vendors reviewed Part I. Part IV provides cost estimates for computer systems, subsystems, and terminals through 1997. Part V discusses the current and potential rules and regulations of the Federal environment and how they may affect the Federal inventory of ADP equipment. Part VI discusses management strategies for the new information technologies with emphasis on microprocessors. Author (GRA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N84-15821# California Univ., Livermore. Lawrence Livermore Lab.

THE 2ND EUROPEAN CONFERENCE ON COMPUTER AIDED DESIGN IN SMALL AND MEDIUM-SIZE INDUSTRIES

W. G. Magnuson, Jr. London Office of Naval Research 29 Mar. 1983 6 p refs Conf. held at Paris, 21-23 Sep. 1982

(AD-A129389) Avail: NTIS HC A02/MF A01 CSCL 09/2

Applications of computer aided design in industries which have limited resources and are forced to innovate in order to compete were emphasized. Specific topics included computer-aided design and manufacturing (CAD-CAM) user groups, mechanical engineering applications, CAD-CAM investment strategies, basic CAD techniques, CAD-CAM education and training, and applications in architecture and building design. GRA

N84-15822# Dayton Univ., Ohio.

DEVELOPMENT OF AN INTERACTIVE COMPUTER PROGRAM TO PRODUCE BODY DESCRIPTION DATA

L. Douglas Baughman Jul. 1983 74 p

(Contract F33615-81-C-0513; AF Proj. 7231)

(AD-A133720; UDR-TR-83-06; AFAMRL-TR-83-058) Avail: NTIS HC A04/MF A01 CSCL 06/5

This report documents program GEBOD (GEnerator of BODy data) an interactive computer program which produces the body description portion of the ATB (Articulated Total Body) Model input deck. The ATB Model simulates the motion and dynamic properties of the human body during events such as aircraft flight seat ejection and automobile crashes. This simulation requires the mass, center of gravity location, contact surface dimensions, joint locations, principal moments of inertia and their associated directions for each of fifteen body segments. The starting point for GEBOD was a program written by Calspan Corporation named GOOD, which was also designed to produce body description data for crash simulation models, For GEBOD, modifications and improvements include: (1) Utilization of different anthropometric data bases for computing regression equations. (2) Changes in segment contact ellipsoid and joint location definitions to make body dimensions more realistic. (3) Use of right elliptical solids in describing torso segments. (4) Incorporating flexibility and user ease into GEBOD's interactive protocol. Author (GRA)

N84-15823# BDM Corp., McLean, Va.

REPORT AND RECOMMENDATIONS FOR IMPROVING CONSTITUTIVE RELATIONS USED IN COMPUTER CODES

S. Nemat-Nasser, G. A. Hegemier, and R. J. Asaro 15 Jul. 1983 30 p

(Contracts MDA903-83-C-0053; DARPA Order 4114)

(AD-A133239; BDM/W-83-444-TR) Avail: NTIS HC A03/MF A01 CSCL 05/1

This Technical Report is the product of a series of meetings held by the technical staff and consultants of The BDM Corporation at the request of, and in cooperation with, representatives of DARPA. The motivation for holding these meetings, and associated technical analyses, was DARPA's interest in large-scale computer calculations of the effects of strong shocks in solids. In addition to related topics, the meetings primarily addressed the subject of improving communication and collaboration between solid mechanics researchers whose principal interest is inelastic constitutive material characterization and numerical analysts whose principal interest is the development and practical use of large computer codes for complex defense related problems. GRA

N84-15824# Navy Personnel Research and Development Center, San Diego, Calif.

TAILORED TESTING THEORY AND PRACTICE: A BASIC MODEL, NORMAL OGIVE SUBMODELS, AND TAILORED TESTING ALGORITHMS

Vern W. Urry Aug. 1983 163 p

(AD-A133385; NPRDC-TR-83-32) Avail: NTIS HC A08/MF A01 CSCL 12/1

In this report, selection theory is used as a theoretical framework from which mathematical algorithms for tailored testing are derived. The process of tailored, or adaptive, testing is presented as analogous to personnel selection and rejection on a series of continuous variables that are related to ability. Proceeding from a single common-factor model, the author derives the two- and three-parameter normal ogive item response functions as submodels. For both of these submodels, algorithms are developed for sequential item selection, ability estimation, and test termination in the context of adaptive ability testing. It is shown that the adaptive testing method based on these algorithms is formally identical to a previously developed Bayesian sequential tailored testing procedure. Author (GRA)

N84-15825# Yale Univ., New Haven, Conn. Dept. of Computer Science.

PROUST: KNOWLEDGE-BASED PROGRAM UNDERSTANDING

W. Lewis Johnson and Elliot Soloway Aug. 1983 35 p

(Contract N00014-82-K-0714)

(AD-A133447; YALEU/DCS/RR-285) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes a program called PROUST which does on-line analysis and understanding of Pascal programs written by novice programmers. PROUST takes as input a program and a non-algorithm description of the program requirements, and finds the most likely mapping between the requirements and the code. This mapping is in essence a reconstruction of the design and implementation steps that the programmer went through in writing the program. A knowledge base of programming plans and strategies, together with common bugs associated with them, is used in constructing this mapping. Bugs are discovered in the process of relating plans to the code; PROUST can therefore give deep explanations of program bugs by relating the buggy code to its underlying intentions. Author (GRA)

N84-15826# Oakland Electric, Inc., Berkeley, Calif. Center for Robotics and Advanced Automation.

DESIGN AND MICROPROCESSOR-BASED IMPLEMENTATION OF DIGITAL FREQUENCY SELECTIVE FILTERS FOR APPLICATION IN TERRAIN ROUGHNESS IDENTIFICATION Interim Report, Jul. 1981 - Apr. 1982

K. C. Cheok and N. K. Loh Apr. 1982 98 p

(Contract DAAE07-81-C-4058)

(AD-A133459; TR-82-04-121; TACOM-TR-12688) Avail: NTIS HC A05/MF A01 CSCL 09/2

The design and implementation of microprocessor-based frequency selective filters for possible use in an on-board terrain roughness identification scheme are investigated. In the design aspect of the investigation, a systematic digital filter design procedure is developed. The effectiveness of the procedure is illustrated by several digital filter design examples. In the implemen-

tation aspect, a digital signal processing firmware (hardware and software) based on the Motorola 6802 microprocessor is developed. The microprocessor realization of the exemplary digital filters are carried out. Actual experimental results are recorded and compared to their theoretical simulations. The capability of the firmware which includes the computational speed and numerical accuracies will be shown to be adequate for the present purpose. Author (GRA)

N84-15827# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
EFFICIENT DEMAND-DRIVEN EVALUATION Interim Research Report
Keshav Pingali and Arvind Sep. 1983 35 p
(Contract N00014-75-C-0661)
(AD-A133477; MIT/LCS/TM-242) Avail: NTIS HC A03/MF A01 CSCL 09/2

This document describes a program transformation technique for programs in a general stream language L whereby a data-driven evaluation of the transformed program performs exactly the same computation as a demand-driven evaluation of the original program. The transformational technique suggests a simple denotational characterization of demand-driven evaluation. Author (GRA)

N84-15828# Louisiana State Univ., Baton Rouge. Computer Graphics Research and Application Lab.
COMPUTER-AIDED STRUCTURAL ENGINEERING (CASE) PROJECT. REFERENCE MANUAL: COMPUTER GRAPHICS PROGRAM FOR GENERATION OF ENGINEERING GEOMETRY (SKETCH) Final Report
John A. Brewer, III , Jeffrey N. Jortner, and Warren N. Waggespack, Jr. Sep. 1983 76 p Sponsored by Army
(AD-A133493; WES-TR-K-83-3) Avail: NTIS HC A05/MF A01 CSCL 09/2

The primary objective of program SKETCH is to assist the user in creation of precise mathematical models of engineering geometry from roughly drawn pictures. A picture or sketch is constructed in an on-line fashion using interactive graphics techniques. The data base which results consists of three-dimensional (3-D) coordinates, lines, polygonal faces, curves, and surfaces. Curved surfaces, however, are not supported in version 3, modification 1, of SKETCH. A user of SKETCH first interactively creates a schematic representation of the intended geometry. The schematic can be a two-dimensional (2-D) cross section or a 3-D pictorial. Straight lines alone are used in the initial sketch. Polygons or polyhedra defined by the lines are dimensioned by the user and automatically converted to a 3-D mathematical model by SKETCH. Arcs, circles, ellipses, and splines can be added after the 3-D conversion takes place. The original straight lines therefore serve as control information and boundary conditions for the curve forms. SKETCH is designed to allow the definition of any engineering geometry, but is particularly advantageous when creating asymmetric geometry. The results of a sketching session is an output file consisting of coordinates, lines, faces, isolated curve segments, and splines. The files can be created or modified with the system editor, if desired. GRA

N84-15829# Naval Postgraduate School, Monterey, Calif.
A GUIDELINE FOR THE PLANNING AND SYSTEM REQUIREMENT DETERMINATION OF A COMPUTER BASED EDUCATIONAL SYSTEM M.S. Thesis
Harry Wayne Johnson Jun. 1983 85 p
(AD-A133529) Avail: NTIS HC A05/MF A01 CSCL 05/9

The objective of this thesis research was to create a guideline that can be followed to plan and determine the system requirements of a computer based educational system. The principle users of this report will be those commands that may not have personnel trained in computer management but desire to investigate the possibility of augmenting or replacing current traditional educational methods. Current advancements in computer technology and production processes have made even the smallest of commands potential users the computer to ensure more effective and efficient personnel training and education. Computer Based Education(CBE) is at the forefront of this advancing technology of computers and possesses the potential to improve individual learning rates and comprehension, but only if the proper system is developed. Guidance for CBE system development is presented in this thesis. Author (GRA)

N84-15830# Oak Ridge National Lab., Tenn. Mathematics and Statistics Research Dept.
SPARSE MATRIX SOFTWARE CATALOG
Michael T. Heath, ed. 27 Oct. 1982 133 p Presented at the Sparse Matrix Symp., Fairfield Glade, Tenn., 24-27 Oct. 1982 Sponsored in part by the Army Research Office, Office of Naval Research and ORNL
(AD-A133559) Avail: NTIS HC A07/MF A01 CSCL 09/2

This software catalog was prepared in conjunction with the Sparse Matrix Symposium in Fairfield Glade, Tennessee, October 25-27, 1982. It is intended to provide information on computer software for sparse matrix problems which should be useful to software developers and consumers alike. The information provided includes the problem domain to which the software is applicable, the method of solution, language and portability details, references to documentation, and a contact for further information or acquiring the software. This information is reported by means of a form which was filled out by each contributor for each item of software. GRA

N84-15831# California Univ., Livermore. Lawrence Livermore Lab.
USE OF 3D GRAPHICS IN SCIENTIFIC DATA ANALYSIS
S. L. Grotch Sep. 1983 8 p refs Presented at Defense Computer-Graphics 1983 Meeting, Washington, D.C., 12 Oct. 1983
(Contract W-7405-eng-48)
(DE84-000911; UCRL-89833; CONF-8310208-1) Avail: NTIS HC A02/MF A01

The focus is on several 3D routine applications. A number of examples illustrate the features needed to produce useful graphical displays. DOE

N84-15832# Bendix Corp., Kansas City, Mo.
OFF-LINE GRAPHICS PROCESSING: A CASE STUDY
D. D. Harris Sep. 1983 44 p Presented at Applicon User's Group Fall Tech. Meeting, Detroit, 6-11 Nov. 1983
(Contract DE-AC04-76DP-000613)
(DE84-002420; BDX-613-2981; CONF-831193-1) Avail: NTIS HC A03/MF A01

A Drafting Systems organization is discussed which is responsible for the creation of computer readable media used for producing photoplots, phototools, and production traveler illustrations, from 1977 when the organization acquired its first Applicon system, until 1982 when the off line graphics processing system was added, the production of Gerber photoplotter tapes and APPLE files presented an ever increasing load on the Applicon systems. The use of a VAX to offload this work from the Applicon systems is described and the techniques used to automate the flow of data from the Applicon sources to the final users are presented. DOE

N84-15833# Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
INTRODUCTION TO THE FORTRAN 14 PROGRAMS DUVOROL AND CONTACT FOR THE SOLUTION OF 3 D ELASTOSTATIC HALF-SPACE CONTACT PROBLEMS WITH AND WITHOUT FRICTION
J. J. Kalker 1982 19 p refs
(PB83-147421; Rept-82-29) Avail: NTIS HC A02/MF CSCL 09B

Two programs, called Duvorol and Contact, are offered. Both are concerned with elastostatic half-space contact problems. Duvorol dates from 1978, and can solve the problem of steady state rolling in a Hertzian geometry completely reliably. It has been tested extensively, with excellent results. Contact dates from

1982; it is Duvorol's successor. It is not confined to Herzian contact, and can calculate non-Hertzian contact areas and normal pressure distributions, steady state rolling, and transient problems both for shifting and for rolling. When given the same problem, Contact is at least 5x as fast as Duvorol in an estimated 97% of the cases. Author

N84-15074# Dowty Electronics Ltd., London (England).
AUTOMATING THE TESTING OF SOFTWARE
N. J. B. Young *In* AGARD Advanced Concepts for Avionics/Weapon System Design, Develop. and Integration Oct. 1983 13 p refs (For primary document see N84-15034 06-01)
Avail: NTIS HC A21/MF A01

N84-16023*# Alabama A & M Univ., Huntsville. Dept. of Engineering Technology.
LOGIC SIMULATOR PROGRAM
R. K. Agarwal *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 11 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N84-15834# Yale Univ., New Haven, Conn. Center for Systems Science.
A LEARNING APPROACH TO ROUTING IN DATA COMMUNICATION NETWORKS
Oleg V. Nedzelnitsky, Jr. and Kumpati S. Narendra Nov. 1982 42 p refs Sponsored by NSF
(Rept-8212) Avail: NTIS HC A03/MF A01

The application of learning methodology to the routing problem in data communication networks in general and the computer communication network as a case of particular interest is discussed. To define the problem precisely, the operating characteristics of the computer communication network and alternative types of routing are described. The principal aim is to demonstrate the feasibility of learning automata routing in message switched and packet switched networks. A Markovian model of the network together with its automata is developed to show the convergence of the overall system state in distribution. Representations of the network as an abstract environment are proposed to predict the equilibrium behavior of the automata routing at the nodes, and this, in turn, is checked by simulation. A number of open problems are indicated which are peculiar to the network discussed. These are mainly concerned with the nonideal nature of the network feedback to the automata including delay and limited network status data and relative performance of different routing methods. M.G.

N84-15835# California Univ., Berkeley. Dept. of Industrial Engineering
A SURVEY OF NETWORK RELIABILITY Research Report
Avinash Agrawal (Tymnet, Inc.) and Richard E. Barlow Jul. 1983 29 p
(Grant AF-AFOSR-0122-81; AF Proj. 2304)
(AD-A133545; ORC-83-5) Avail: NTIS HC A03/MF A01 CSCL 09/2

We present a brief survey of the current state of the art in network reliability. We survey only exact methods; Monte Carlo methods are not surveyed. Most network reliability problems are, in the worst case, NP-hard and are, in a sense, more difficult than many standard combinatorial optimization problems. Although the above sounds very discouraging, there are in fact linear and polynomial time algorithms for network reliability problems of special structure. We review general methods for network reliability computation and discuss the central role played by domination theory in network reliability computational complexity. We also point out the connection with the more general problem of computing the reliability of coherent structure. The class of coherent structures contains both directed and undirected networks as well as logic (or fault) tress without not gates. GRA

N84-15836# Oak Ridge Gaseous Diffusion Plant, Tenn.
COMPUTER-OUTPUT MICROFICHE (COM) ON THE OAK RIDGE COMPUTER NETWORK
F. M. OHara, Jr. Aug. 1983 84 p refs
(Contract W-7405-eng-26)
(DE84-002422; K/CSD/INF-83/20) Avail: NTIS HC A05/MF A01

The computer network at the Department of Energy research and production plants in Oak Ridge has the capability of producing computer output microfiche on centralized facilities. Different computers in the network have different ways to access this output capability. These different ways are: the output class, the cataloged procedure PCOM, the utility program LCOM, the MIC file COM, and user written macros. The uses of these different methods are explained and described in this manuals, and examples of their use are presented. DOE

N84-15837# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
THE DEBUGGING OF REAL TIME MULTIPROCESSOR SYSTEMS: AN INTEGRATED SOLUTION PROPOSAL [IL DEBUGGING DI SISTEMI MULTI-PROCESSORE REAL-TIME: UNA PROPOSTA DI SOLUZIONE INTEGRATA]
M. Borghesi, P. Mello (Telettra SpA, Milan), and A. Natali (Bologna Univ.) 1983 13 p refs In ITALIAN Presented at A.I.C.A. Congr., Naples, 28-30 Sep. 1983 Sponsored by CNR
(CISE-2067) Avail: NTIS HC A02/MF A01

A debugging method used to detect errors in the operation tests of a multi-micro programming line is described. The system includes a target system descriptor and a distributed program builder which allows for modifications of the hardware configurations and software allocation policies. The debugger design is related to an execution control system, and whenever possible the same mechanisms are used in the two applications. The set of commands, which is detailed, supports program control activities in the operation phase. The debugging is evolved towards an execution control language characterized by having the same syntax and semantics as the main multi-micro-programming line. Local and global recovery after error detection are discussed.
Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N84-15838# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
EXPLOITING TEMPORAL KNOWLEDGE TO ORGANIZE CONSTRAINTS Interim Report
Stephen F. Smith 19 Jul. 1983 41 p
(Contract F49620-82-K-0017)
(AD-A133417; CMU-RI-TR-83-12) Avail: NTIS HC A03/MF A01 CSCL 09/4

This paper examines the role of temporal knowledge in regard to the representation and utilization of constraints within time dependent problem domains. The author first considers the representation of constraints whose interpretations may vary in different temporal regions of the solution space. A representation that organizes constraint variants via the temporal relationships among them is presented and seen to support a simple mechanism for determining the applicable variant at any point in time. He then turns his attention to the management of temporal constraints that are dynamically imposed as various commitments are made by the reasoning system (e.g. as resources are allocated to activities in a plan). Constraint propagation techniques which collectively insure consistency in the hypotheses under develop-

ment are presented and discussed. These techniques are driven by the temporal relationships present in the domain model. This work is motivated by ongoing research with ISIS, an intelligent scheduling and information system currently being applied to the problem of scheduling job shops, and examples throughout the paper are drawn from this domain. Author (GRA)

N84-15839# Denver Research Inst., Colo.
ARTIFICIAL INTELLIGENCE: AN ANALYSIS OF POTENTIAL APPLICATIONS TO TRAINING, PERFORMANCE MEASUREMENT, AND JOB PERFORMANCE AIDING Interim Report, Sep. 1982 - Jul. 1983
J. Jeffrey Richardson Lowry AFB, Colo. Air Force Human Resources Lab. Sep. 1983 78 p
(Contract F33615-82-C-0013; AF Proj. 1121)
(AD-A133592; AFHRL-TP-83-28) Avail: NTIS HC A05/MF A01 CSCL 05/9

This paper is part of a planning effort to develop a research, development, and applications program for the utilization of artificial intelligence (AI) technology in three target areas: training, performance measurement, and job performance aiding. The paper introduces the reader to AI and those subfields of AI that are most relevant to this program, reports on relevant ongoing research and development sponsored by the Department of Defense, establishes the challenges facing the Air Force in the three target areas and explains how each presents opportunities for AI applications, draws out important practical concerns which must be faced by an AI research and development program, and finally, proposes a set of recommendations for building an Air Force AI applications program in training, performance measurement, and job performance aiding. Author (GRA)

N84-15840 Rensselaer Polytechnic Inst., Troy, N. Y.
DIRECT MULTIVARIABLE MODEL REFERENCE ADAPTIVE CONTROL WITH APPLICATIONS TO LARGE STRUCTURAL SYSTEMS Ph.D. Thesis
Izhak Bar-Kana 1983 253 p
Avail: Univ. Microfilms Order No. DA8321179

The need for adaptive control of any system arises because of ignorance of the systems internal structure and critical parameter values, as well as changing control regimes. A large scale system is substantially more susceptible to these problems. Although considerable progress has been made in designing Model Reference adaptive controllers for unknown single input single output control systems, little progress has been made toward extension of these ideas to the multi-input multi-output (multivariable) case. Furthermore, most adaptive control procedures need the order of the (assumably unknown) controlled plant and use a reference model of the same order as the plant for implementation of the adaptive algorithm. Direct Multivariable Model Reference Adaptive Control (DMMRAC) procedures which do not require explicit parameter identification or a reference model of the same order as the plant seem to be especially attractive for the control of large structural systems. However, in the past they were shown to only be feasible for systems which satisfy the strictly positive realness condition. Dissert. Abstr.

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N84-15841# Institute of Space and Astronautical Science, Tokyo (Japan).
SYNTHESIS OF INSENSITIVE CONTROLLERS IN LINEAR QUADRATIC CONTROL PROBLEMS
Junichiro Kawaguchi Sep. 1983 121 p refs
(Rept-605; ISSN-0285-6808) Avail: NTIS HC A06/MF A01

The insensitive controller which guarantees the robustness explicitly in terms of parameter variations while preserving the performance in terms of cost is considered. The insensitive controller design that keeps its structure as usual regulators from the view point of reliability is considered. The Additive Term Design methods in which the proper additional terms are introduced in the covariance propagation equations or the cost equations in order to assess the deterioration of the performance index (cost) are evaluated. Some properties of these Additive Term Designs are clarified. Improving the cost surfaces, the stability, the stability margins, and the sensitivity with respect to the equivalent open loop systems is shown. These techniques are applied to three numerical examples. One is the longitudinal autopilot of aircraft and the others are the estimation problem of radar tracking and the attitude control system of a large flexible booster. Author

N84-15842# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Science.
AN ALGORITHM FOR DETECTING A CHANGE IN STOCHASTIC PROCESS
Rakesh Kumar Bansal and P. Papantoni-Kazakos Jun. 1983 24 p
(Grant AF-AFOSR-3695-78; AF Proj. 2304)
(AD-A134104; UCT/DEECS/TR-83-7; AFOSR-83-0781TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The problem of detecting a change from one given stationary and ergodic stochastic process, to another given such process is considered. It is assumed that both the stochastic processes are processes with memory, and that they are mutually independent. A sequential test is proposed and analyzed. It is proved that the proposed test is asymptotically optimal, in a mathematically precise sense. The test utilizes a reflecting barrier at zero, and positive threshold for deciding the occurrence of the change.
Author (GRA)

N84-15843# Naval Civil Engineering Lab., Port Hueneme, Calif.
AN INVESTIGATION OF THE INDIRECT BOUNDARY ELEMENT METHOD IN ONE- AND TWO-DIMENSIONAL ELASTOSTATICS
T. A. Shugar and J. V. Cox May 1983 114 p
(ZR00001179)
(AD-A133142; NCEL-TN-1664) Avail: NTIS HC A06/MF A01 CSCL 12/1

This report presents a study of the indirect boundary element method and its potential advantages for solving one- and two-dimensional linear structural/stress analysis problems. The theoretical formulation of the indirect boundary element method is illustrated first by developing the framework of one-dimensional beams resting on elastic foundations, and then extending the same concept to the framework of two-dimensional plane stress or plane strain elastostatics. Computer programs were written both in BASIC and FORTRAN that numerically implement the theoretical application is written in FORTRAN. Accuracy of the indirect boundary element solution is assessed through comparison with theoretical solutions and with solutions from the alternative, direct boundary element method. With regard to edge effects, the implementation that was available for comparison. The results pertaining to the accuracy of the indirect boundary element method to correctly capture stress gradients were very encouraging, even for the constant stress elements employed. The results suggest that the method may be a very economical analysis tool for determining stress concentration factors in elastostatics. Because the necessary input data requirements are less and smaller matrices result, the boundary element methods are more suited to small computers, thus enhancing the use of the methods as effective stress analysis tools. Author (GRA)

N84-15844# Stanford Univ., Calif. Dept. of Statistics.
ON THE FITTING OF PEARSON CURVES TO SUMS OF INDEPENDENT RANDOM VARIABLES
Thomas Sellke 19 May 1983 34 p
(Contract N00014-76-C-0475)
(AD-A133153; TR-333) Avail: NTIS HC A03/MF A01 CSCL 12/1

It is shown that the distribution of a sum of independent beta random variables is often well approximated by a properly scaled beta distribution. The relationship between the type of Pearson

curve which best fits a sum of independent random variables and the types of the Pearson curves which best fit the sum and random variables is also investigated. The best fitting Pearson curve for a distribution is defined here to be the unique Pearson curve with the same first four moments. GRA

N84-15845# Yale Univ., New Haven, Conn. Dept of Computer Science.

AN INVESTIGATION OF THE USE OF ITERATIVE LINEAR EQUATION SOLVERS IN CODES FOR LARGE STIFF SYSTEMS OF ODE'S Final Report

Tony Chan 18 Jul. 1983 8 p

(Grant AF-AFOSR-0193-81; AF Proj. 2304)

(AD-A133189; AFOSR-83-0746TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This project deals with the problem of solving large systems of stiff ODEs. In particular, seen as one of the major issues is the choice of methods for solving the systems of linear and nonlinear equations that arise at each integration step. It is proposed to use variants of the preconditioned conjugate gradient method for solving the linear equations, and truncated Newton-like iterations for solving the nonlinear equations. The main objective is to determine whether the use of iterative methods for solving linear systems of algebraic equations in codes for large stiff systems of ODEs is competitive with sparse direct techniques. A more tangible objective is to produce a computer program that incorporates such an approach. GRA

N84-15846# Brown Univ., Providence, R. I.

INTRODUCTION TO DYNAMIC BIFURCATION Interim Report

Jack K. Hale May 1983 49 p

(Contract DAAG29-79-C-0161; Grants AF-AFOSR-0198-81; NSF MCS-82-05355; AF Proj. 2304)

(AD-A133252; LCDS-83-16; AFOSR-83-0772TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Dynamic bifurcation theory in differential equations is concerned with the changes that occur in the structure of the limit sets of solutions as parameters in the vector field are varied. For example, if the vector field is the gradient of a function with a finite number of critical points, then the omega-limit set of each orbit is an equilibrium point. Thus, one must be concerned with how the number of equilibrium points changes with the parameters (this is usually called static bifurcation theory), how the stability properties of the equilibrium points change and the manner in which the equilibrium points are connected to each other by orbits. If the vector field is not the gradient of a function, then other types of limiting motions can occur; for example, periodic orbits, invariant tori, homoclinic and heteroclinic orbits. The purpose of these notes is to give an introduction to the methods used in determining how these more complicated limit sets change as parameters vary.

Author (GRA)

N84-15847# North Carolina Univ., Chapel Hill. Dept. of Statistics.

A LAW OF THE ITERATED LOGARITHM FOR NON-PARAMETRIC REGRESSION FUNCTION ESTIMATORS

Wolfgang Hardle May 1983 19 p

(Contract F49620-82-C-0009; AF Proj. 2304)

(AD-A133260; MIMEO SER-1527; AFOSR-83-0776TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We prove a law of the iterated logarithm for nonparametric regression function estimators using strong approximations to the two dimensional empirical process. We consider the case of Nadaraya-Watson kernel estimators and of estimators based on orthogonal polynomials when the marginal density of the design variable X is unknown or known. Author (GRA)

N84-15848# Desmatics, Inc., State College, Pa.

A NOTE ON THE ANALYSIS OF RANDOM BALANCE DESIGNS

Carl A. Mauro Sep. 1983 10 p

(Contract N00014-79-C-0650; NR Proj. 042-467)

(AD-A133287; TR-113-11) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this report the use of separate F-tests as a method of analysis for Random Balance designs is discussed. The validity of this test procedure is shown by relating the RB model to the exchangeable linear model. For this latter model, the usual F-tests are known to be valid for certain hypotheses. Author (GRA)

N84-15849# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.

A REPRESENTATION FOR SHAPE BASED ON PEAKS AND RIDGES IN THE DIFFERENCE OF LOW-PASS TRANSFORM Interim Report

James L. Crowley and Alice C. Parker May 1983 39 p Prepared in cooperation with University of Southern California, Los Angeles

(Grants N00039-79-Z-0169; NSF AR-75-08154)

(AD-A133299; CMU-RI-TR-83-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper defines a multiple resolution representation for the two-dimensional gray-scale shapes in an image. This representation is constructed by detecting peaks and ridges in the Difference of Low Pass (DOLP) transform. Descriptions of shapes which are encoded in this representation may be matched efficiently despite changes in size, orientation or position. Motivations for a multiple resolution representation are presented first, followed by the definition of the DOLP Transform. Techniques are then presented for encoding a symbolic structural description of forms from the DOLP transform. This process involves detecting local peaks and ridges in each band-pass image and in the entire three-dimensional space defined by the DOLP transform. Linking adjacent peaks in different band-pass images gives a multiple resolution tree which describes shape. Peaks which are local maxima in this tree provide landmarks for aligning, manipulating, and matching shapes. Detecting and linking the ridges in each DOLP band-pass image provides a graph which links peaks within a shape in a band-pass image and describes the positions of the boundaries of the shape at multiple resolutions. Detecting and linking the ridges in the DOLP three space describes elongated forms and links the largest peaks in the tree. The principles for determining the correspondence between symbols in pairs of such descriptions are then described. Such correspondence matching is shown to be simplified by using the correspondence at lower resolutions to constrain the possible correspondence at higher resolutions.

Author (GRA)

N84-15850# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.

APPLICATION OF THE GIBBS DISTRIBUTION TO IMAGE SEGMENTATION

H. Elliott, H. Derin, R. Cristi, and D. Geman Aug. 1983 30 p

(Contract N00014-83-K-0059)

(AD-A133406; UMASS-ECE-AUG83-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report presents a new statistical approach to the image segmentation problem. By modelling image data as a Markov random field characterized by a Gibbs distribution, a dynamic programming algorithm is developed. The primary contribution of the paper is this new near optimal method for processing scenes described by the non-causal Gibbs model. The report is organized as follows. Section 2 defines the segmentation problem in a statistical framework, introduces some notation, and presents some background on Markov random fields. Section 3 then presents the dynamic programming algorithm in detail for the case of segmenting images consisting of uniform intensity regions in high levels of additive white Gaussian noise. Section 4 presents results of applying the algorithms to some experimentally generated images consistent with this model as well as some synthetic aperture radar images which are clearly inconsistent with the assumed model. These results clearly demonstrate the applicability of the technique to realistic data as well as the robustness of the algorithm with respect to modelling assumptions. In Section 5, some comments and concluding remarks are given, and extensions to this work which are in progress are briefly outlined. GRA

N84-15851# Wisconsin Univ., Madison. Dept. of Statistics.
EXPERIMENTAL DESIGNS FOR QUANTAL RESPONSE MODELS Final Report, 24 Jun. 1982 - 23 Jun. 1983
Chien-Fu Jeff Wu 22 Sep. 1983 5 p
(Contract DAAG29-82-K-0154)
(AD-A133416; ARO-19298.3-MA) Avail: NTIS HC A02/MF A01 CSCL 12/1

Three problems have been studied. A new sequential design procedure has been developed for estimating the percentiles of a quantal response curve which describes the probability of response as a function of stimulus level. It is asymptotically fully efficient and distribution-free. For small samples it outperforms the best Robbins-Monro procedure in an extensive empirical study. The percentages of saving range from 25% to 60%. It is shown that, by classifying the outcome of a sensitivity experiment into more than two categories, the parameters in a parametric response curve can be estimated more precisely. The theoretical result is obtained via the Missing Information Principle. The empirical study points out where substantial gains can be achieved. Several procedures for the multiple comparison of all linear contrasts in unbalanced situations are compared both empirically and theoretically. Recommendations for the choice of procedures are given.
Author (GRA)

N84-15852# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
THE TRAVELLING SALESMAN PROBLEM IN GRAPHS WITH 3-EDGE CUTSETS
G. Cornuejols, D. Naddef (Univ. Scientifique et Medicale de Grenoble), and W. Pulleyblank (Waterloo Univ.) Aug. 1983 52 p
(Contract N00014-82-K-0329; Grants NSF ENG-79-02506; NSF ECS-82-05425)
(AD-A133504; MSRR-494) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper the authors decomposition properties of a graph which, when they occur, permit a polynomial solution of the traveling salesmen problem and a description of the travelling salesman polytope by a system of linear equalities and inequalities. The central notion is that of a 3-edge cutset, namely a set of 3 edges which, when removed, disconnects the graph. Conversely, their approach can be used to construct classes of graphs for which there exists a polynomial algorithm for the travelling salesman problem. The approach on two examples is illustrated: Halin graphs and prismatic graphs.
Author (GRA)

N84-15853# Technion - Israel Inst. of Tech., Haifa. Dept. of Mathematics.
OPTIMAL RECONSTRUCTIONS AND n-WIDTHS Final Technical Report
A. A. Melkman and A. Pinkus Jun. 1983 12 p
(Contract DAJA37-80-C-0234; DA Proj. 1T1-61102-BH-57)
(AD-A133576) Avail: NTIS HC A02/MF A01 CSCL 12/1

This research has been concerned with the interrelated subjects of n-widths and optimal reconstruction. An attempt has been made to establish a mathematical framework within which a general theory may be developed. In addition, two important problems have been solved. The first of these deals with n-widths of Sobolev spaces, while the second is concerned with optimal reconstruction and n-widths of time- and band-limited signals.
Author (GRA)

N84-15854# Los Alamos Scientific Lab., N. Mex. Center for Nonlinear Studies.
NUMERICAL METHODS FOR TRACKING INTERFACES
James M. Hyman 1983 26 p refs Presented at the Fronts, Interfaces and Patterns Conf., Los Alamos, N. Mex., 2 May 1983
(Contract W-7405-eng-36)
(DE84-001730; LA-UR-83-3049; CONF-8305110-5) Avail: NTIS HC A03/MF A01

An overview is given of special numerical methods for tracking discontinuous fronts and interfaces. These methods include: surface tracking methods based on connected marker points along the interface, volume-tracking methods that track the volume occupied by the solution regions bounded by the interfaces, and moving mesh methods where the underlying mesh is aligned and moved with the interface. The pros and cons of the current methods are discussed, and a new method is proposed that overcomes some of the difficulties encountered in approximating equations with multiply interacting interfaces.
DOE

N84-15855# European Space Agency, Paris (France).
EXPLICIT SECOND ORDER SPLITTING SCHEMES FOR SOLVING HYPERBOLIC NONLINEAR PROBLEMS: THEORY AND APPLICATION TO TRANSONIC FLOW
Pierre Laval Oct. 1983 283 p refs Transl. into ENGLISH of "Schemas Explicites de Desintegration du Second Ordre pour la Resolution des Problemes Hyperbolics non Lineaires. Theorie et Applications aux Ecoulements Transsoniques" rept. ONERA-NT-1981-10 ONERA, Paris, 1981
(ESA-TT-768; ONERA-NT-1981-10) Avail: NTIS HC A13/MF A01

Explicit second-order splitting schemes for solving hyperbolic nonlinear unsteady two or three dimensional systems were constructed. They employ the one-dimensional second order accurate schemes of Lerat-Peyret at the fractional step stages. These integer step schemes, with 4, 6, or 8 parameters in the two-dimensional case and with 6, 10, or 12 parameters in the three-dimensional case, are shown to be second-order accurate. The differential systems which these schemes approximate are derived with third order accuracy. The splitting schemes are applied to the two-dimensional fluid dynamics equations for steady and unsteady transonic flow calculations, with shocks, over oscillating or fixed airfoils, in a wind tunnel with solid or perforated walls, and in an infinite domain. Results for an airfoil oscillating with small amplitude show that the behavior of the unsteady forces is close to harmonic, even though the shock motion is nonsinusoidal; the noncyclic transient state persists for only two cycles.
Author (ESA)

N84-15856# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
NUMERICAL MODELING AND FAST-SOLVER CALCULATION OF APPROXIMATELY NORMAL SHOCKS
J. W. Boerstoel 12 May 1982 12 p refs Presented at BAIL II Conf., Dublin, 16-18 Jun. 1982
(NLR-MP-82026-U) Avail: NTIS HC A02/MF A01

The design of finite difference equations over shocks, and the rapid calculation of such flows with a fast solver are discussed. The fast solver is a combination of Newton iteration and full multigrid relaxation. It was applied to steady transonic potential flows in a one-dimensional channel and around an airfoil. The fast solver has full convergence speed if shock-wave positions are updated by a simple special subalgorithm in the fast solver; this subalgorithm eliminates discontinuity jumps that arise at shocks during iterations. Results of numerical experiments illustrate the findings.
Author (ESA)

N84-15857# Fondazione Ugo Bordoni, Rome (Italy).
MAXIMUM ENTROPY LINEAR PREDICTION METHOD [METODI DI PREDIZIONE LINEARE A MASSIMA ENTROPIA]
Giuseppe Martinelli (Rome Univ.) and Gianni Orlandi (Rome Univ.) Dec. 1982 22 p refs In ITALIAN
(FUB-48-1982) Avail: NTIS HC A02/MF A01

A justification of the maximum entropy method based on information theory is presented. The problem of the optimal order of the digital filter required is examined. Low orders produce flat spectra which cancel the higher resolution advantage, and high orders introduce spurious details in the spectrum. The final prediction error criterion is discussed, showing that the order found may be too low and that experimental verification is necessary.
Author (ESA)

N84-15858# Fondazione Ugo Bordoni, Rome (Italy).
LINEAR PREDICTION METHODS [METODI DI PREDIZIONE LINEARE]
Giuseppe Martinelli, Gianni Orlandi, and Mario Salerno Dec. 1982 19 p refs In ITALIAN Prepared in cooperation with Rome Univ.

(FUB-52-1982) Avail: NTIS HC A02/MF A01

The theory of linear prediction to obtain the information carried by a signal emerging from a physical structure is reviewed. The transfer function of the physical system in the Z domain is assumed to the characterized by a polynomial with all zeroes within the unit circle. In the stationary case and in the time domain, the coefficients define a filter called linear predictor. The number N of coefficients is the order of the predictor. Obtaining the linear predictor by the least square method is explained. Solution methods for the normal equations, including the iterative method due to Levinson-Durbin, are discussed. Author (ESA)

N84-15859# Fondazione Ugo Bordoni, Rome (Italy).
GEOMETRIC METHODS FOR LINEAR PREDICTION [METODI GEOMETRICI DI PREDIZIONE LINEARE]
Giuseppe Martinelli (Rome Univ.) and Gianni Orlandi (Rome Univ.) Dec. 1982 40 p In ITALIAN
(FUB-54-1982) Avail: NTIS HC A03/MF A01

The least squares ladder method is applied to one channel cases. The method is based on the exact sequential minimization of the prediction error energy. The method is a geometric interpretation in a Hilbert space of the linear prediction theory. The geometric derivation of the prediction is proved from a vector notation of linear prediction. The procedure is shown to be particularly powerful in the case in which the stationary state hypothesis of the given mode is not valid. Author (ESA)

N84-15860# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
SOME NEW DEVELOPMENTS IN EXACT INTEGRAL EQUATION FORMULATIONS FOR SUB- OR TRANSONIC POTENTIAL FLOW
J. W. Slooff 11 May 1982 25 p refs Presented at Intern. School of Appl. Aerodyn., 1st Course on Computational Meth. in Potential Aerodyn., Amalfi, Italy 31 May - 5 Jun. 1982
(NLR-MP-82024-U) Avail: NTIS HC A02/MF A01

Finite volume type spatial discretization schemes for the full potential equation based on flux splitting, and multigrid (multilevel) techniques for fast iterative solution of systems of equations associated with panel methods, including fast procedures for approximate evaluation of the integral representations required for the determination of the residuals at each iteration step, are described. Results suggest the feasibility of developing a next generation of boundary + field panel methods for sub and transonic potential flow equipped with fast-solvers that are almost an order of magnitude more efficient than those of the current boundary panel methods. Author (ESA)

N84-15861# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
A SURVEY OF SOLUTION TECHNIQUES FOR NONLINEAR FINITE ELEMENT EQUATIONS
W. C. Rheinboldt (Pittsburgh Univ.) May 1982 82 p refs Submitted for publication
(NLR-MP-82027-U; ICMA-82-35) Avail: NTIS HC A05/MF A01

The continuation method or incremental method for the solution of the equilibrium equations that describe the deformation response of structure under variable loading is introduced. Numerical concepts related to the solution of nonlinear equations in many variables are summarized. Application of the continuation method for the analysis of structural stability problems is discussed. Trends in improved computational efficiency are reviewed. Author (ESA)

N84-15862# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
A LOCAL-RELAXATION METHOD FOR SOLVING CONVECTION-DIFFUSION EQUATIONS
E. F. F. Botta (Groningen Rijksuniversiteit, Netherlands) and A. E. P. Veldmann 28 May 1982 9 p refs Presented at 8th Intern. Conf. on Numerical Meth. in Fluid Dyn., Aachen, 28 Jun.-2 Jul. 1982
(NLR-MP-82030-U) Avail: NTIS HC A02/MF A01

A local-relaxation (LR) method in which the relaxation factor is a function of the coefficients of the local equation is presented. The method is applied to central difference approximations of convection-diffusion equations. It is found that equations with small diffusion coefficients can be handled without difficulty. For equations with strongly varying coefficients, and for nonlinear equations, the LR method can be significantly more efficient than the optimum successive overrelaxation method. Author (ESA)

N84-15863# Technische Hogeschool, Delft (Netherlands). Onderafdeling der Wiskunde en Informatica.
CONSTRAINED FUNCTION MINIMIZATION. COMPARISON OF THE AUGMENTED LAGRANGIAN AND SEQUENTIALLY INCREASING PENALTY METHOD
C. deWit 1983 30 p refs
(PB83-217265; Rept-83-03) Avail: NTIS HC A03/MF A01 CSCL 12A

The problem of minimizing a function of n variables, while these variables are subject to a number of equality and/or inequality constraints is discussed. This problem is solved in two ways: (1) by means of minimizing the objective function, augmented with a sequentially increasing (exterior) penalty function, denoted as the Sequentially Increasing Penalty method; and (2) by working with the corresponding Lagrange function, augmented with a fixed (exterior) penalty to guarantee local convexity. This last method is denoted as the Augmented Lagrangian method. The effectiveness and robustness of the two methods are compared within the context of a few examples. M.G.

N84-15864# Technische Hogeschool, Delft (Netherlands). Electromagnetic Research Lab.
LEAST-SQUARE ITERATIVE TECHNIQUES FOR SOLVING INTEGRAL EQUATIONS
Peter M. vandenBerg Jul. 1982 14 p refs
(PB83-166751; Rept-1982-05) Avail: NTIS HC A02/MF A01 CSCL 12A

Two iterative techniques for solving integral equations are considered. The integrated square error is taken as the measure of deviation of the approximate solution from the exact solution. Starting with an arbitrary initial guess and a set of arbitrary chosen correction functions a convergent iteration scheme an be developed. Two special choices for the correction functions are considered: (1) the steepest-descent method (the correction function is used as the function providing the steepest descent of the integrated square error; (2) the conjugate gradient method (an orthogonal set of the chosen correction functions is obtained following from the steepest-descent method). M.G.

N84-15884 Selenia S.p.A., Rome (Italy). Naval Systems Div.
AN APPROACH TO LOGISTIC PROBLEMS BY THE L-TRANSFORM METHOD
Ubaldo G. Florio *In its* Riv. Tec. Selenia, Vol. 8, No. 2, 1982 1982 p 14-20 refs (For primary document see N84-15882 06-70)
Avail: Issuing Activity

N84-15890 Selenia S.p.A., Rome (Italy). Radar Dept.
THE MAXIMUM ENTROPY METHOD AND ITS APPLICATION TO CLUTTER CANCELLATION
Egidio dAddio, Alfonso Farina, and Flavio A. Studer *In its* Riv. Tec. Selenia, Vol. 8, No. 3, 1983 1983 p 15-24 refs (For primary document see N84-15887 06-70)
Avail: Issuing Activity

N84-16024*# Alabama Univ., Huntsville. Dept. of Mathematics.
THE GENERALIZED EULER-MASCHERONI CONSTANTS
R. Ainsworth *In its* Res. Rept.: NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 13 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 12A

N84-16044*# Middle Tennessee State Univ., Murfreesboro.
POPULATION CONTROL OF SELF-REPLICATING SYSTEMS: OPTION C
Richard L. McCord *In* Alabama Univ. Res. Rept.:

1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 16 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 12A

N84-16048*# Alabama Univ., Huntsville. Dept. of Mathematics.
STATISTICAL ANALYSIS OF A DEBUGGING MODEL
Kyle Siegrist *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 24 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 12A

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N84-15865# Oak Ridge National Lab., Tenn. Mathematics and Statistics Research Dept.
ASSESSMENT OF FISHER AND LOGISTIC LINEAR QUADRATIC DISCRIMATION MODELS
C. K. Bayne, J. J. Beauchamp, V. E. Kane (Ford Motor Co., Detroit), and G. P. McCabe Feb. 1983 70 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-TM-200) Avail: NTIS HC A04/MF A01

The results from a simulation study comparing the performance of the Fisher and logistic linear and quadratic discriminant functions are summarized. Three types of bivariate distributions are studied. Each classification rule is compared to the optimal maximum likelihood procedure for the different data types. The theoretical misclassification probabilities of the sample discriminant functions are calculated directly and used for the comparison of the different procedures both in terms of bias and variation. Generalizations and recommendations are made to assist the applied statistician in making the correct choice of a discrimination procedure and the results of this study are compared with earlier investigations. It is shown that specification of the form of the discriminant function may be one of the most important parts of a discriminant analysis. M.G.

N84-15866*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOME PROPERTIES OF A 5-PARAMETER BIVARIATE PROBABILITY DISTRIBUTION Final Report
J. D. Tubbs (Arkansas Univ., Fayetteville), D. W. Brewer (Arkansas Univ., Fayetteville), and Orvel E. Smith Dec. 1983 149 p refs (Contract NAS8-34502)
(NASA-TM-82550; NAS 1.15:82550) Avail: NTIS HC A07/MF A01 CSCL 12A

A five-parameter bivariate gamma distribution having two shape parameters, two location parameters and a correlation parameter was developed. This more general bivariate gamma distribution reduces to the known four-parameter distribution. The five-parameter distribution gives a better fit to the gust data. The statistical properties of this general bivariate gamma distribution and a hypothesis test were investigated. Although these developments have come too late in the Shuttle program to be used directly as design criteria for ascent wind gust loads, the new wind gust model has helped to explain the wind profile conditions which cause large dynamic loads. Other potential applications of the newly developed five-parameter bivariate gamma distribution are in the areas of reliability theory, signal noise, and vibration mechanics. Author

N84-15867# North Carolina Univ., Chapel Hill. Chapel Hill Inst of Statistics.
ON JACKKNIFING KERNEL REGRESSION FUNCTION ESTIMATORS
Wolfgang Hardle May 1983 12 p Sponsored in part by Deutsche Forschungsgeneinschaft Sonderforschungsbereich
(Contract F49620-82-C-0009; AF Proj. 2304)
(AD-A133236; Mimeo-Ser-1526; AFOSR-83-0775TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Estimation of the value of a regression function at a point of continuity using a kernel-type estimator is discussed and improvements of the technique by a generalized jackknife estimator are presented. It is shown that the generalized jackknife technique produces estimators with faster bias rates. In a small example it is investigated, if the generalized jackknife method works for all choices of bandwidths. It turns out that an improper choice of this parameter may inflate the mean square error of the generalized jackknife estimator. Author (GRA)

N84-15868# North Carolina Univ., Chapel Hill. Inst. of Statistics.
ON THE MAXIMUM LIKELIHOOD ESTIMATE FOR LOGISTIC ERRORS-IN-VARIABLES REGRESSION MODELS Annual Report
Raymond J. Carroll May 1983 12 p
(Contract F49620-82-C-0009; AF Proj. 2304)
(AD-A133253; MIMEO-SER-1528; AFOSR-83-0773TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Maximum likelihood estimates for errors-in-variables models are not always root-N consistent. We provide an example of this for logistic regression. Author (GRA)

N84-15869# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON BAYES AND EMPIRICAL BAYES RULES FOR SELECTING GOOD POPULATIONS
Shanti S. Gupta and Lii-Yuh Leu Sep. 1983 25 p
(Contract N00014-75-C-0455)
(AD-A133336; AD-E950445; TR-83-37) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper deals with the problems of selecting all populations which are close to a close to a control or standard. A general Bayes rule for the above problem is derived. Empirical Bayes rules are derived when the populations are assumed to be uniformly distributed. Under some conditions on the marginal and prior distributions, the rate of convergence of the empirical Bayes risk to the minimum Bayes risk is investigated. Author (GRA)

N84-15870# University of Southern Illinois, Carbondale. Dept of Statistics.
AN ESTIMATION PROBLEM RELATING TO SUBSET SELECTION FOR NORMAL POPULATIONS
S. Jeyaratnam and S. Panchapakesan Purdue Univ. Aug. 1983 26 p Prepared in cooperation with Purdue Univ., Lafayette, Ind.
(Contract N00014-75-C-0455)
(AD-A133387; AD-E950446; TR-83-38) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let p sub 1, p sub 2,..., pi sub k be k independent normal populations with unknown means theta sub 1, theta sub 2,..., theta sub k, respectively, and a common known variance tau sub 2. The population associated with the largest theta sub i is called the best population. In the subset selection approach, the authors want to select a nonempty subset of the k populations so that it includes the best population with a minimum guaranteed probability. The basic idea of the subset selection approach is that the number of populations to be selected should depend upon the evidence supplied by the data. GRA

N84-15871# Illinois Univ., Chicago. Dept of Statistics.
THE 2-STAGE SELECTION PROCEDURES BASED ON TESTS
Klaus J. Miescke Purdue Univ. Sep. 1983 22 p Prepared in cooperation with Purdue Univ., Lafayette, Ind.
(Contract N00014-75-C-0455)
(AD-A133405; TR-83-39) Avail: NTIS HC A02/MF A01 CSCL 12/1

Suppose that k new treatments have been developed with the purpose of replacing the standard treatment with the best new one, provided that it is actually an improvement on the standard treatment. In a parametric approach, mainly under the assumption of monotones likelihood ratios, procedures are considered which, at a first stage, screen out inferior treatments through statistical tests at a common level of significance. If none (exactly one) is not eliminated, none (this one) will be used as a replacement.

Otherwise, if more than one treatment overcomes this screening process, that one of the non-eliminated treatments will be chosen as the replacement which is judged to be the best, after additional data have been observed from the selected treatments. Topics of this paper are the questions of how to choose the terminal decision at the second stage and the tests at the first stage, respectively, and how to implement the appropriate procedures at certain pre-specified performance criteria.
Author (GRA)

N84-15872# Chicago Univ., Ill. Center for Decision Research.
AMBIGUITY AND UNCERTAINTY IN PROBABILISTIC INFERENCE
Hillel J. Einhorn and Robin M. Hogarth Sep. 1983 83 p
(Contract N00014-81-K-0314)
(AD-A133418) Avail: NTIS HC A05/MF A01 CSCL 12/1

Ambiguity results from having limited knowledge of the process that generates outcomes. It is argued that many real-world processes are perceived to be ambiguous; moreover, as Ellsberg demonstrated, this poses problems for theories of probability operationalized via choices amongst gambles. A descriptive model of how people make judgments under ambiguity in tasks where data come from a source of limited, but not exactly known reliability, is proposed. The model assumes an anchoring-and-adjustment process in which data provides the anchor, and adjustments are made for what might have been. The latter is modeled as the result of a mental simulation process that incorporates the unreliability of the source and one's attitude toward ambiguity in the circumstances. A two-parameter model of this process is shown to be consistent with: Keynes' idea of the weight of evidence, the non-additivity of complementary probabilities, current psychological theories of risk, and Ellsberg's original paradox. The model is tested in four experiments at both the individual and group levels. In experiments 1-3, the model is shown to predict judgments quite well; in experiment 4, the inference model is shown to predict choices between gambles. The results and model are then discussed with respect to the importance of ambiguity in assessing perceived uncertainty; the use of cognitive strategies in judgments under ambiguity; the role of ambiguity in risky choice; and extensions of the model. Author (GRA)

N84-15873# Virginia Polytechnic Inst. and State Univ., Blacksburg.
TWO STOCHASTIC MODELING PROBLEMS IN COMMUNICATIONS AND NAVIGATION Final Report, 1 Jul. 1979 - 30 Jun. 1983
Werner E. Kohler 12 Sep. 1983 6 p
(Contract DAAG29-79-C-0085)
(AD-A133458; ARO-16539.6-MA) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two problems were studied, the effects of random gravitational fluctuations upon the performance of inertial navigation systems and the effect of random scatterers upon wave propagation. GRA

N84-15874# Maryland Univ., Baltimore.
FITTING A MULTIPLE REGRESSION FUNCTION
Ibrahim A. Ahmad and Pi-Erh Lin (Florida State Univ., Tallahassee) Dec. 1982 25 p
(Contract N00014-80-C-0093)
(AD-A133482; FSU-STATISTICS-M650; ONR-TR-180) Avail: NTIS HC A02/MF A01 CSCL 12/1

A statistical problem which finds a wide range of applications is the estimation of a regression function. In this document an estimate is proposed when there are at least two independent regressors. This is not a direct generalization of the Priestley-Chao estimate. Also presented is a consistent estimate for the error variance. With the aid of the variance estimate, an asymptotic confidence interval can be constructed. GRA

N84-15875# European Space Agency, Paris (France).
STATIONARY STOCHASTIC PROCESSES
Christian Delhote Oct. 1983 93 p refs Transl. into ENGLISH of "Processus Aleatoires Stationnaires" rept. ONERA-NT-1982-4 ONERA, Paris, 1982
(ESA-TT-812; ONERA-NT-1982-4) Avail: NTIS HC A05/MF A01

The high resolution capabilities of spectral analysis techniques are discussed. Techniques based on the Fourier transform give a frequency resolution inversely proportional to the observation interval, and give rise to sidelobes. These can be reduced by windowing, but to the detriment of the resolution. In methods which use process identification theory to determine a model based on the available data, the estimated spectrum is taken to be that of the model; thus better resolution is anticipated. The calculation of the parameters of autoregressive and autoregressive moving average models, using a least squares or a maximum likelihood criterion is discussed. The use of the model for analysis of nonstationary signals is described. Radar signal processing, particularly short duration measurements and nonstationarity of the signals analyzed, is considered. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N84-15876# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
IMPROVED DYNAMIC MODELS FOR AIR COMBAT ANALYSIS
N. Farber, M. Negrin, and J. Shinar Mar. 1982 121 p refs
(TAE-483) Avail: NTIS HC A06/MF A01

A zero-order feedback solution to the three-dimensional medium range air-to-air interception engagement, formulated as a zero-sum differential game is provided. Realistic aerodynamic and propulsion models are used and control strategies are given in a feedback form, expressing explicitly the dependence on the measurable state variable and aircraft performance parameters. The successive analysis is based on an innovative, variable modelling approach applying the method of forced singular perturbations. An imaginary air defense scenario serves as an illustrative example, showing the efficiency and the usefullness of the method for a rapid systematical parametric study. The accuracy of the zero-order feedback approximation is satisfactory and for most cases, higher order terms may be not needed; however corrective terms can be obtained by additional off-line computation. The FSPT algorithm for optimal medium range air combat strategy in a future flight test program is recommended. A.R.H.

N84-15877*# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
NONLINEAR TRANSFORMAT
H. Ford, L. R. Hunt, and R. Su Jan. 1983 8 p refs
(Grants NAG2-189; NAG2-203)
(NASA-CR-166506; NAS 1.26:166506) Avail: NTIS HC A02/MF A01 CSCL 12B

A technique for designing automatic flight controllers for aircraft which utilizes the transformation theory of nonlinear systems to linear systems is presently being developed at NASA Ames Research Center. A method is considered in which a given nonlinear is transformed to a controllable linear system in Brunovsky canonical form. A linear approximation is introduced to the nonlinear system called the modified tangent model. This model is easily computed. Constructing the transformation for this model enables the designer to find an approximate transformation for the nonlinear system. B.W.

N84-15878# Massachusetts Inst. of Tech., Cambridge. Artifical Intelligence Lab.
ANALYZING THE ROLES OF DESCRIPTIONS AND ACTIONS IN OPEN SYSTEMS
Carl Hewitt and Peter deJong Apr. 1983 16 p
(Contract N00014-80-C-0505)
(AD-A133614; AI-M-727) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper analyzes relationships between the roles of

descriptions and actions in large scale, open ended, geographically distributed, concurrent systems. Rather than attempt to deal with the complexities and ambiguities of currently implemented descriptive languages, we concentrate our analysis on what can be expressed in the underlying frameworks such as the lambda calculus and first order logic. By this means we conclude that descriptions and actions complement one another; neither being sufficient unto itself. This paper provides a basis to begin the analysis of the very subtle relationships that hold between descriptions and actions in Open Systems. Author (GRA)

N84-15879# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Nachrichtentheorie.
A MINIMAX THEOREM FOR ANTIJAMMING GROUP CODES
Thomas Ericson Jul. 1983 50 p refs
(DFVLR-FB-83-30) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 16,50

A game theory approach to signal jamming, in which the minimax error probability is a measure of performance, is presented. For antijamming group codes, the theorem characterizes the error probability as an infimum of the probability function of the correct decision. The cases of frequency hopping and direct sequence are illustrated. Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N84-15880*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE GENERALIZED EULER-MASCHERONI CONSTANTS
O. R. Ainsworth (Alabama Univ.) and L. W. Howell Jan. 1984 15 p refs
(NASA-TP-2264; NAS 1.60:2264) Avail: NTIS HC A02/MF A01 CSCL 12A

Methods for evaluating the Euler-Mascheroni constants which appear in the Laurent expansion of the Reimann zeta function about Z = 1 are presented. The first 32 of these numbers are listed. Author

N84-15881# Fundacao Calouste Gulbenkian, Lisbon (Portugal). Inst. Gulbenkian de Ciencia.
ELEMENTS OF FUNCTIONS OF A COMPLEX VARIABLE
F. Teixeira deQueiroz 1982 67 p refs
Avail: NTIS HC A04/MF A01

Differential of a function of a complex variable, the integral of a function of a complex variable, residue theory, representation of functions by means of integrals, representation of holomorphic functions, evaluation of improper integrals, simplification of concepts and choice of rotation, first properties of the complete integral, and barriers of continuity are discussed. Author

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N84-15882 Selenia S.p.A., Rome (Italy).
RIVISTA TECNICA SELENIA, VOLUME 8, NUMBER 2, 1982
1982 37 p refs
Avail: Issuing Activity

Military, meteorological and topographical laser telemetry is discussed. A logistics management model based on the Laplace transformation is presented. Optimum and suboptimum processors for multistatic radar are compared. A digital ferrite phase shifter for high power S band operation is described. For individual titles, see N84-15883 through N84-15886.

N84-15883 Selenia S.p.A., Rome (Italy). Research Dept.
ADVANCED TECHNIQUES OF LASER TELEMETRY **c17**
Silvano Donati (Pavia Univ.) and Aldo Gilardini *In its* Riv. Tec. Selenia, Vol. 8, No. 2, 1982 1982 p 1-13 refs (For primary document see N84-15882 06-70)
Avail: Issuing Activity

The relationships which govern a laser telemeter; noise sources; and measurement accuracy with pulsed and sinusoidal intensity modulation techniques are discussed. Developments in telemetry instrumention and optical detection are considered. Meteorological interferometers, geodimeters, and military telemeters are described. Propagation attenuation and signal to noise ratios are treated. It is shown that accuracy depends on the product of measurement time and received power. The frequency scanning technique of CW and long pulse telemetry; multifrequency techniques; pulse compression; and vernier technique are outlined. Author (ESA)

N84-15884 Selenia S.p.A., Rome (Italy). Naval Systems Div.
AN APPROACH TO LOGISTIC PROBLEMS BY THE L-TRANSFORM METHOD **c64**
Ubaldo G. Florio *In its* Riv. Tec. Selenia, Vol. 8, No. 2, 1982 1982 p 14-20 refs (For primary document see N84-15882 06-70)
Avail: Issuing Activity

A computation model for the average unavailability waiting time of spares and optimization procedure of the total cost of a store with replaceable spare parts is presented. The model is based on the Laplace transformation. The probability space examined is the real axis, and experimental results are the failure times of the observed system. Computation examples for the Poisson model case validate the approach. Author (ESA)

N84-15885 Selenia S.p.A., Rome (Italy). Radar Factory.
OPTIMUM AND SUB-OPTIMUM PROCESSORS FOR MULTISTATIC RADAR SYSTEMS **c32**
Egidio dAddio, Alfonso Farina, Maurizio Longo (Naples Univ.), and Ernesto Conte (Naples Univ.) *In its* Riv. Tec. Selenia, Vol. 8, No. 2 1982 p 21-28 refs (For primary document see N84-15882 06-70)
Avail: Issuing Activity

The optimum receiver, allowing for the presence of Gaussian noise and Rayleigh fluctuations of the target echoes, is synthesized for a multistatic radar system. The performance of such a receiver is analyzed, showing that the target detection characteristics of the multistatic system compare advantageously with those of the monostatic system. The inherent complexity of the multistatic structure may be alleviated by a simplified scheme which envisages a number of peripheral decisions in as many conventional receivers, followed by a central decision based on an operations research criterion. The latter design yields a suboptimum receiver, but an assessment of its performance shows the existence of a wide range of operating conditions of practical engineering interest where performance degradation with respect to the optimum receiver is negligible. Author (ESA)

N84-15886 Selenia S.p.A., Rome (Italy). Research Dept.
A DIGITAL FERRITE PHASE-SHIFTER FOR HIGH POWER S-BAND OPERATION **c33**
Giuseppe Cattarin, Carlo diGregorio, Umberto Parrucci, Fioravante Pucci, and Riccardo Roveda *In its* Riv. Tec. Selenia, Vol. 8, No. 2 1982 p 29-34 refs (For primary document see N84-15882 06-70)
Avail: Issuing Activity

A nonreciprocal digital phase shifter in a rectangular waveguide was developed. Insertion loss for negative and positive polarization is 0.74 and 0.52 average, respectively, with rms deviation = 0.03. Differential phase shifts of five bits at saturation indicate good reproducibility of ferrite reactive parameters. Insertion phase and asymmetry are satisfactory. Author (ESA)

N84-15887 Selenia S.p.A., Rome (Italy).
RIVISTA TECNICA SELENIA, VOLUME 8, NUMBER 3, 1983
1983 41 p refs

Avail: Issuing Activity

The impact of local area network techniques on shipboard systems was assessed. A radar signal processor implemented with surface acoustic waves devices is described. A maximum entropy method application to clutter cancellation is presented. The meteorological data distribution mission on board Sirio 2 satellite, and the repeater and despun antenna are outlined. For individual titles, see N84-15888 through N84-15891.

N84-15888 Selenia S.p.A., Rome (Italy). Naval Systems Div.
LOCAL AREA NETWORKS: IMPACT ON SHIPBOARD APPLICATIONS **c32**
Gianfranco DalBuono *In its* Riv. Tec. Selenia, Vol. 8, No. 3, 1983 1983 p 1-8 (For primary document see N84-15887 06-70)
Avail: Issuing Activity

The International Standards Organization model for open system interconnection was applied to a system on board ships. The methodology adopts a standard protocol for each of seven layers; the means identified is that of defining a posteriori a standard protocol for the fourth layer only, forcing its adoption by all the already existing shipboard networks. Interoperability is achieved, and it is possible to define a standard protocol for all layers, permitting complete standardization of shipboard networks. Author (ESA)

N84-15889 Selenia S.p.A., Rome (Italy). Central Development Lab.
A RADAR SIGNAL PROCESSOR IMPLEMENTED WITH SURFACE ACOUSTIC WAVES DEVICES **c32**
Tullio Bucciarelli, Alessandro Manuale, Roberto Ronconi, and Giovanni Picardi (Rome Univ.) *In its* Riv. Tec. Selenia, Vol. 8, No. 3, 1983 1983 p 9-14 refs (For primary document see N84-15887 06-70)
Avail: Issuing Activity

A spectrum analyzer using the chirp Fourier transform is presented. Algorithms used to implement the Fourier transform for analog and digital cases are analyzed. The Fourier transform is evaluated by multiplying the signal by a down chirp, then convolving the result with an up chirp with the same slope and multiplying the output of the convolver with a chirp equal to the first used. In the spectrum analyzer, the pulse is created by a ringing oscillator at a frequency of 60 MHz and is amplified to a peak power of 20 dBm. This pulse is used to trigger the first chirp generator. Due to the SAW device insertion loss, a second amplifier is used to feed the input mixer with power = + 13 dBm. The ringing oscillator synchronizes a pulse generator with a variable delay. A PROM simulates input signals (of sine type). The number of pulses can be changed to simulate different signals. The Hamming weights are inserted in proper sequences loaded in the PROM whose output is converted and translated to the right frequency. Author (ESA)

N84-15890 Selenia S.p.A., Rome (Italy). Radar Dept.
THE MAXIMUM ENTROPY METHOD AND ITS APPLICATION TO CLUTTER CANCELLATION **c64**
Egidio dAddio, Alfonso Farina, and Flavio A. Studer *In its* Riv. Tec. Selenia, Vol. 8, No. 3, 1983 1983 p 15-24 refs (For primary document see N84-15887 06-70)
Avail: Issuing Activity

Two high resolution techniques for spectral estimation of random processes based on the maximum entropy method are described. The estimate is obtained from samples of the autocorrelation function or directly from samples of the process. Application to a radar system is shown. An estimation of clutter spectrum is exploited to shape a filter for clutter cancellation and target echo enhancement. The processing algorithm is adaptive. Its performances are evaluated, by computer simulation, in terms of improvement factor and speed of adaptation. Author (ESA)

N84-15891 Selenia S.p.A., Rome (Italy). Space Div.
THE METEOROLOGICAL DATA DISTRIBUTION MISSION ON BOARD SIRIO SATELLITE **c32**
Lamberto Sartini *In its* Riv. Tec. Selenia, Vol. 8, No. 3, 1983 1983 p 25-37 refs (For primary document see N84-15887 06-70)
Avail: Issuing Activity

The SIRIO 2 meteorological data distributor mission and the related telecommunication package, comprising an S band repeater and a despun antenna system assembly are described. The repeater assembly receives and amplifies signals via a low noise amplifier, down converts them to an intermediate frequency (IF) and amplifies these signals at IF, to generate a TLM carrier phase modulated by the PCM signals from the on board telemetry encoder. It sums the IF signal and the TLM carrier and up converts them to an S band frequency, and provides power amplification of the composite signal for retransmission. The despun antenna system functions are: provide a beamwidth at the receive and transmit frequency bands sufficient to meet the coverage requirements; provide gain over the coverage at the receive and transmit frequencies; and acquire and maintain the pointing of the beam towards Earth during all mission lifetime by despinning the antenna structure with a rotary motion having the same satellite angular speed but opposite direction. Author (ESA)

N84-15892# Fermi National Accelerator Lab., Batavia, Ill.
MAGNETIC-FIELD CONSIDERATIONS IN SUPERFERRIC DIPOLE
S. C. Snowdon 21 Mar. 1983 13 p
(Contract DE-AC02-76CH-03000)
(DE84-002573; FERMILAB/TM-1210) Avail: NTIS HC A02/MF A01

Iron dominated magnets are characterized in the limit of infinite permeability by a pole shape that is a magnetic equipotential. Deviations from this ideal because of finite permeability are associated with differences in path length, local saturation, flux concentration in slotted pole if crenellation is used, and sub surface voids. For moderate field levels the variation in flux path length throughout the iron lowers the magnetic potential on the iron surface more for the longer paths. As the excitation increases, the permeability is lowered in regions of high flux density. Crenellation in this region offers some degree of control over the permeability by concentrating the flux. To a lesser degree sub surface voids can be used to control the reluctance of a flux path. The net result suggests that the shape of the effective air gap can be adjusted to be a magnetic equipotential sensibly equivalent to the ideal pole shape for infinite permeability. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution.*

N84-15893 George Washington Univ., Washington, D.C.
THE PARABOLIC APPROXIMATION FOR SOUND PROPAGATION IN STRATIFIED MOVING MEDIA Ph.D. Thesis
Gerry Lee McAninch 1981 151 p
Avail: Univ. Microfilms Order No. DA8320059

An asymptotic theory for the equations governing sound propagation in a stratified moving medium is developed. The theory is based on the geometric acoustics approximation and is therefore valid for high frequency or short wavelength. In contrast to the geometric acoustic approximation, which provides an asymptotic expansion as a series of terms which satisfy ordinary differential equations along the rays, the approximation developed is the product of the lowest order term of the geometric theory and a function which satisfies a parabolic equation with the coordinate along the ray cast in a time like role. This equation accounts for the diffractions effects missed in the lowest order geometric theory which occur whenever there is a variation in the acoustic pressure on neighboring rays. The cumulative effect caused by the presence of small pressure differences on neighboring rays acting over a large propagation distance is resolved. Dissert. Abstr.

N84-15894*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FLUID SHIELDING OF HIGH-VELOCITY JET NOISE
Jack H. Goodykoontz Jan. 1984 22 p refs
(NASA-TP-2259; E-1705; NAS 1.60:2259) Avail: NTIS HC A02/MF A01 CSCL 20A

Experimental noise data for a nozzle exhaust system incorporating a thermal acoustic shield (TAS) are presented to show the effect of changes in geometric and flow parameters on attenuation of high-velocity jet exhaust noise in the flyover plane. The results are presented for a 10.00-cm-diameter primary conical nozzle with a TAS configuration consisting of a 2.59- or 5.07-cm-wide annular gap. Shield-stream exhaust velocity was varied from 157 to 248 m/sec to investigate the effect of velocity ratio. The results showed that increasing the annular gap width increases attenuation of high-frequency noise when comparisons are made on the same ideal thrust basis. Varying the velocity ratio had a minor effect on the noise characteristics of the nozzles investigated. Author

N84-15895# British Library Lending Div., Boston Spa (England).
ASPECTS OF DAMPING OF SONIC VIBRATIONS DUE TO IMPACT LOADING IN PLATE STEELS
V. N. Brinza, L. N. Moskaleva, and A. A. Parfenov 7 Oct. 1983 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. (USSR), no. 1, 1983 p 107-111
(BLL-M-35295-(5828.4)) Avail: British Library Lending Div., Boston Spa, Engl.

In an attempt to determine the cause of noise emission in rolling mills, sound emission from St3sp plate steel after a number of different hot rolling overall reductions was studied. Hot rolling was found to have a marked influence on sound emission from plates. A marked increase in sound level was observed after an overall reduction of about 80%. Heat treatment (quenching and tempering) do not generally improve the acoustic properties of plate steel. The relationship between acoustic properties and certain physical properties (internal friction, density and electrical resistivity) was also studied. Author

N84-15896*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPINNING MODE ACOUSTIC RADIATION FROM THE FLIGHT INLET Final Report
William F. Moss Nov. 1983 33 p refs Prepared in cooperation with Clemson Univ., S.C.
(Contracts NAS1-16394; NAS1-17130)
(NASA-CR-172273; NAS 1.26:172273; REPT-83-63) Avail: NTIS HC A03/MF A01 CSCL 20A

A mathematical model was developed for spinning mode acoustic radiation from a thick wall duct without flow. This model is based on a series of experiments (with and without flow). A nearly pure azimuthal spinning mode was isolated and then reflection coefficients and far field pressure (amplitude and phase) were measured. In our model the governing boundary value problem for the Helmholtz equation is first converted into an integral equation for the unknown acoustic pressure over a disk, S1, near the mouth of the duct and over the exterior surface, S2, of the duct. Assuming a pure azimuthal mode excitation, the azimuthal dependence is integrated out which yields an integral equation over the generator C1 of S1 and the generator C2 of S2. The sound pressure on C1 was approximated by a truncated modal expansion of the interior acoustic pressure. Piecewise linear spline approximation on C2 was used. Author

N84-15897*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACOUSTIC SHOCKS IN A VARIABLE AREA DUCT CONTAINING NEAR SONIC FLOWS Final Report
S. I. Hariharan and Harold C. Lester Dec. 1983 21 p refs Prepared in cooperation with Tennessee Univ.
(Contracts NAS1-17070; NAS1-17130)
(NASA-CR-172274; NAS 1.26:172274; REPT-83-64) Avail: NTIS HC A02/MF a01 CSCL 20A

Acoustic shock waves in a variable area duct which contains near sonic flows are considered. The problem is modeled after an aeroengine inlet. Area variation of a duct and high Mach number mean the flow reduces acoustical energy yielding substantial noise reduction. One possible reason for this is acoustic shock. The use of an explicit accurate numerical method which captures shocks is described. Comparison of the results are made with an existing asymptotic theory for Mach numbers close to unity. When shock occurs reduction of sound pressure levels are shown by example. Author

N84-15898*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A REVIEW OF UNDERWATER ACOUSTIC SYSTEMS AND METHODS FOR LOCATING OBJECTS LOST AT SEA
Ray W. Lovelady and Robert L. Ferguson Nov. 1983 72 p refs
(NASA-TM-85727; NAS 1.15:85727) Avail: NTIS HC A04/MF A01 CSCL 20A

Information related to the location of objects lost at sea is presented. Acoustic devices attached to an object prior to being transported is recommended as a homing beacon. Minimum requirements and some environmental constraints are defined. Methods and procedures for search and recovery are also discussed. Both an interim system and a more advanced system are outlined. Controlled acoustic emission to enhance security is the theme followed. Author

N84-15899# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
TRANSONIC NOISE GENERATION BY DUCT AND PROFILE FLOW Annual Report, Apr. 1982 - Apr. 1983
G. E. A. Meier, R. Timm, and F. Becker London European Research Office Apr. 1983 45 p refs
(Contract DAJA37-81-C-0251)
(AD-A129367; AR-2) Avail: NTIS HC A03/MF A01 CSCL 20/1

Aeroacoustic sound generation is discussed. The strong sound generation in helicopter rotor vortex interaction was studied and a vortex profile flow interaction experiment was performed in a transonic duct. Vortices are generated upstream of a NACA 0012 profile and the pressure fields are analyzed digitally. An automatic interferogram analysis technique is adapted to the problem to evaluate densities, pressures and vortex traces from the interferograms. It is found that a separation bubble is formed at the leading edge of the wing when the vortex passes over the profile. It is suggested that complicated flow at the boundary of the profile is one of the keys to the understanding of vortex profile interaction. E.A.K.

N84-15900# Federal Aviation Administration, Washington, D.C. Office of Environment and Energy.
AIRPORT NOISE CONTROL STRATEGIES
Patricia A. Cline Jun. 1983 91 p
(AD-A133137; FAA/EE-83-3) Avail: NTIS HC A05/MF A01 CSCL 20/1

This report provides a comprehensive listing of noise control strategies employed by the nation's airports. Forty-four categories of noise control actions have been identified and are in use, singly or in combination, by over 540 airports. Updated versions of this report will be issued periodically. GRA

N84-15901# Woods Hole Oceanographic Institution, Mass.
THE NUMERICAL SYNTHESIS AND INVERSION OF ACOUSTIC FIELDS USING THE HANKEL TRANSFORM WITH APPLICATION TO THE ESTIMATION OF THE PLANE WAVE REFLECTION COEFFICIENT OF THE OCEAN BOTTOM Ph.D. Thesis
Douglas Robert Mook Sep. 1983 231 p Prepared in cooperation with Massachusetts Inst. of Tech.
(Contracts N00014-82-C-0152; N00014-81-K-0742; Grant NSF ECS-80-07102)
(AD-A133156; WHOI-83-27) Avail: NTIS HC A11/MF A01 CSCL 20/1

The plane wave reflection coefficient is an important geometry independent means of specifying the acoustic response of a horizontally stratified ocean bottom. It is an integral step in the inversion of acoustic field measurements to obtain parameters of the bottom and it is used to characterize an environment for the

purpose of acoustic imaging. This thesis studies both the generation of synthetic pressure fields through the plane wave reflection coefficient and the inversion of measured pressure fields to estimate the plane wave reflection coefficient. These are related through the Sommerfeld integral which is in the form of a Hankel transform. The Hankel transform is extensively studied in this thesis and both applications. When we apply them to the generation of synthetic data, we obtain hybrid numerical-analytical algorithms which provide extremely accurate synthetic fields without sacrificing computational speed. These algorithms can accurately incorporate the effects of trapped modes guided by slow speed layers in the bottom. We also apply these tools to study the inverion of measured pressure field data for the plane wave coefficient. We address practical issues associated with the inversion procedure including removal of the source field, sampling, field measurements over a finite range, and uncontrolled variations in source-height. A phase unwrapping and associated interpolation scheme is developed to handle improperly space data. GRA

N84-15902# Scripps Institution of Oceanography, La Jolla, Calif. Marine Physical Lab.
MARINE ENVIRONMENTAL ACOUSTICS Final Report, 1 Nov. 1979 - 15 Dec. 1982
Kenneth M. Watson and Victor C. Anderson 1 Aug. 1983 15 p
(Contract N00014-80-C-0219)
(AD-A133245; MPL-U-51/83) Avail: NTIS HC A02/MF A01 CSCL 20/1

The Marine Environmental Acoustics Program of the Marine Physical Laboratory can be best typified as one with an experimental emphasis, addressing the acoustic, hydrodynamic, magnetic environments of the ocean. In particular we are concerned with understanding the interaction of the environment with the Navy's needs in undersea detection, localization and communication. Author (GRA)

N84-15903# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DISTRIBUTED SENSOR NETWORK Semiannual Technical Summary Report, 1 Oct. 1982 - 31 Mar. 1983
Richard T. Lacoss 31 Mar. 1983 45 p
(Contract F19628-80-C-0002; Grant ARPA Order 3345; DA Proj. 3D30; DA Proj. 3T10)
(AD-A133250; ESD-TR-83-028) Avail: NTIS HC A03/MF A01 CSCL 17/1

The Distributed Sensor Networks (DSN) program is aimed at developing and extending target surveillance and tracking technology in systems that employ multiple spatially distributed sensors and processing resources. Such a system would be made up of sensors, data bases, and processors distributed throughout an area and interconnected by an appropriate digital data communication system. Surveillance and tracking of low-flying aircraft has been selected to develop and evaluate DSN concepts in the light of a specific system problem. A DSN test bed that will make use of multiple small acoustic arrays as sensors for low-flying aircraft surveillance is being developed and will be used to test and demonstrate DSN techniques and technology. This Semiannual Technical Summary (SATS) reports results for the period 1 October 1982 though 31 March 1983. Initial validation tests of a three-node message-based distributed acoustic surveillance system were conducted during this reporting period. The system consisted of three test-bed nodes interconnected and controlled by a separate experiment control and communication (ECC) computer. In addition to providing message based internodal communications, the ECC also serves as a system user interface. Improvements needed to support detailed distributed system experiments were identified and have been partially implemented. GRA

N84-15904# Pennsylvania State Univ., University Park. Applied Research Lab.
ACOUSTIC DIFFRACTION BY AN IMPEDANCE-COVERED EDGE M.S. Thesis
Mehmet Marsan 15 Jun. 1983 142 p
(Contract N00024-79-C-6043)
(AD-A133266; AD-E750854; ARL/PSU/TM-83-95) Avail: NTIS HC A07/MF A01 CSCL 20/1

The prediction of the sound scattered by impedance covered wedges is obtained by use of dual integral equations. The impedance of each face of the wedge is modeled as a point reacting complex quantity which is independent of the other face. The solution was constructed as an angular spectrum to satisfy the boundary conditions and Sommerfeld radiation condition. The solution kernel was obtained exactly and is in terms of circular functions. The solution of the scattered pressure was then obtained for far-field and mid-range by use of asymptotic techniques. This solution is much simpler than the one developed by Russian scientists (for example, see G.D. Maliuzhinets, "The Radiation of Sound by Vibrating Boundaries of an Arbitrary Wedge', Parts 1 and 2, Soviet Physics Acoustics, pp. 152-174 and 240-248 (1955)) which was obtained by a method similar to Wiener-Hopf technique. Thus, it is easier to use in highway noise applications because of its simplicity. The solution for the diffracted pressure exhibits clearly the role of the incident and reflected shadow boundaries and shows there is one minimum in the scattered field which depends on the two surface impedances. For backscattered pressure, the solution exhibits two minima. In all cases, the scattered pressure becomes negligible near the wedge surfaces. Author (GRA)

N84-15905# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
AERODYNAMIC SOURCES OF ACOUSTIC RADIATION FROM A SINGLE MOD-2 WIND TURBINE
N. D. Kelley, R. R. Hemphill, and H. E. McKenna Sep. 1983 10 p refs Presented at the Am. Solar Energy Soc. Meeting, Minneapolis, 1-3 Jun. 1983
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(DE84-000013; SERI/TP-215-2009; CONF-830622-27) Avail: NTIS HC A02/MF A01

The acoustic measurement program which used the MOD-2 wind turbines is reported. Low frequency acoustic emission characteristics are summarized. The MOD-2 acoustic emissions are compared with other large scale turbines, including the DOE/NASA MOD-OA, the MOD-1 horizontal axis, and the DOE/Sandia vertical axis designs. The unsteady aerodynamic forcing, in response to certain freestream turbulence characteristics, is identified as the source of observed acoustic and rotor aeroelastic responses. DOE

N84-15027# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HELICOPTER NOISE
S. Lewy and M. Caplot *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 44 p refs Previously announced in IAA as A83-48195 (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

N84-15028# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL METHODS IN COMPRESSOR NOISE STUDIES
S. Lewy and B. Jubelin (SNECMA, Moissy-Cramayel, France) *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 37 p refs Previously announced in IAA as A83-48194 (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

N84-15029# Southampton Univ. (England). Inst. of Sound and Vibration Research.
A REVIEW OF SOURCE LOCATION/ASSESSMENT TECHNIQUES
M. J. Fisher and B. J. Tester (Rolls Royce Ltd., Derby, England) *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 26 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

N84-15030# Southampton Univ. (England). Inst. of Sound and Vibration Research.
SHOCK ASSOCIATED NOISE
M. J. Fisher *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 17 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

N84-15031*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERATION OF SOUND IN TURBULENT SHEAR FLOWS
Marvin E. Goldstein *In* Von Karman Inst. for Fluid Dynamics Aeroacoustics: Ten Years of Res. 1983 72 p refs (For primary document see N84-15025 06-01)
Avail: NTIS HC A14/MF A01

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N84-15906 Brookhaven National Lab., Upton, N. Y. Dept. of Physics.
LATTICE GAUGE THEORIES
Michael Creutz Apr. 1983 6 p refs Presented at the Non-Perturbative Quantum Chromodyn. Conf., Stillwater, Okla., 7-9 Mar. 1983
(Contract DE-AC02-76CH-00016)
(DE83-013114; BNL-33016; CONF-830368-1) Avail: NTIS HC A02

Lattice gauge theory which has become the primary tool for the study of nonperturbative phenomena in gauge theories is discussed. The lattice serves as an ultraviolet cutoff, rendering the theory well defined and amenable to numerical and analytical work. The lattice is not tied to the Feynman expansion which opens the possibility of other approximation schemes than conventional perturbation theory. A high temperature expansion was used to demonstrate confinement in the strong coupling limit. Monte Carlo simulations have dominated the research in lattice gauge theory giving first principle calculations of nonperturbative parameters characterizing the continuum limit. DOE

N84-15907 University of Western Michigan, Kalamazoo.
SIMULTANEOUS ELECTRON CAPTURE AND EXCITATION IN ION-ATOM COLLISIONS
J. A. Tanis, E. M. Bernstein, W. G. Graham (New Univ. of Ulster), M. Clark (North Carolina Univ., Chapel Hill), S. M. Shafroth (North Carolina Univ., Chapel Hill), B. M. Johnson (Brookhaven National Lab.), K. W. Jones (Brookhaven National Lab.), and M. Meron (Brookhaven National Lab.) 1982 4 p refs Presented at the 7th Conf. on the Appl. of Accelerators in Res. and Ind., Denton, Tex., 8 Nov. 1982
(Contract DE-AC02-76CH-00016)
(DE83-005799; BNL-32343; CONF-821123-33) Avail: NTIS HC A02

Efforts to observe simultaneous electron capture and K shell excitation in ion atom collisions are reviewed. This process referred to as resonant transfer and excitation (RTE), is qualitatively analogous to dielectronic recombination in free electron ion collisions, and is expected to be resonant. In an experiment involving 70-160 MeV S(13) ions incident on Ar, a maximum was observed in the yield of projectile K x rays associated with electron capture. This maximum is attributed to simultaneous capture and excitation. The position (120 MeV) and width (60 MeV) of the observed maximum are in agreement with theoretical calculations. It is indicated that RTE is an important mechanism for inner shell vacancy production in the energy range studied. DOE

N84-15908 Brookhaven National Lab., Upton, N. Y.
IMPROVED FOUR-STAGE ACCEL-DECEL PRODUCTION OF LOW-ENERGY STRIPPED HEAVY IONS
P. Thieberger, J. Barrette, B. M. Johnson, K. W. Jones, M. Meron, and H. E. Wegner 1982 3 p refs Presented at the 7th Conf. on the Appl. of Accelerators in Res. and Ind., Denton, Tex., 8 Nov. 1982
(Contract DE-AC02-76CH-00016)
(DE83-005791; BNL-32344; CONF-821123-36) Avail: NTIS HC A02

The two model MP Tandem Van de Graaff accelerators were used in a four stage accel-decel configuration to produce highly stripped low energy heavy ions. The performance in this mode of operation was improved by modifications of the second accelerator. The inclined field acceleration tube electrodes at the exit of this accelerator were replaced by straight electrodes, the vacuum was improved and the maximum negative terminal potential was increased. Higher intensity beams of heavier highly stripped ions can now be produced at lower energies than before. DOE

N84-15909*# California Univ., Los Angeles. Dept. of Physics.
ON THE RELATIONSHIP BETWEEN COLLISIONLESS SHOCK STRUCTURE AND ENERGETIC PARTICLE ACCELERATION
C. F. Kennel (TRW Systems) [1983] 18 p refs
(Contracts NGL-05-007-190; NAS5-20682)
(NASA-CR-175328; NAS 1.26:175328) Avail: NTIS HC A02/MF A01 CSCL 20H

Recent experimental research on bow shock structure and theoretical studies of quasi-parallel shock structure and shock acceleration of energetic particles were reviewed, to point out the relationship between structure and particle acceleration. The phenomenological distinction between quasi-parallel and quasi-perpendicular shocks that has emerged from bow shock research; present efforts to extend this work to interplanetary shocks; theories of particle acceleration by shocks; and particle acceleration to shock structures using multiple fluid models were discussed.
Author

N84-15910# California Univ., Berkeley. Lawrence Berkeley Lab. Particle Data Group.
MAJOR DETECTORS IN ELEMENTARY PARTICLE PHYSICS
G. Gidal, B. Armstrong, and A. Rittenberg Mar. 1983 86 p refs
(Contract DE-AC03-76SF-00098; Grant NSF PHY-80-22530)
(LBL-91; UC-37) Avail: NTIS HC A05/MF A01

Tables and drawings show the properties and performance characteristics of the world's major detectors of elementary particle physics. Some notable omissions in the first edition include bubble chambers and any associated spectrometers, and the still somewhat tentative LEP, SLC, and TRISTAN detectors. A.R.H.

N84-15911# California Univ., Berkeley. Lawrence Berkeley Lab.
PROCEEDINGS OF THE 1983 DPF WORKSHOP ON COLLIDER DETECTORS: PRESENT CAPACITIES AND FUTURE POSSIBILITIES
Stewart C. Loken, ed. and Peter Nemethy, ed. Apr. 1983 198 p refs Workshop held in Berkeley, Calif., 28 Feb. - 4 Mar. 1983
(Contract DE-AC03-76SF-00098)
(LBL-15973; CONF-830224) Avail: NTIS HC A09/MF A01

Problems posed by high luminosities at hadron colliders were addressed, including: luminosities on a continuous range from 1 x 10 to the 29th power to 1 x 10 to the 34th power/square cm. sec; two specific center of mass energies, 1 TeV and 20 TeV; use of synchrotron radiation for electron identification at high luminosity; caorimetry; particle identification and detector systems. For individual titles, see N84-15912 through N84-15940.

N84-15912# California Univ., Berkeley. Lawrence Berkeley Lab.
EXPERIENCE OF THE AXIAL FIELD SPECTROMETER AT THE CERN ISR
William J. Willis *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 5-20 (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The axial field spectrometer is a facility designed with an emphasis on flexibility and measurements of energy by calorimeters of very good energy and angle resolution for both electromagnetic and hadronic particles. It is designed for moderate luminosities, 10 to the minus 31st or 32nd power/square cm 5 or interaction

rates from 0.4 to 4 MHz, and charged particle multiplicities up to 50. Data from several experiments were discussed. B.G.

N84-15913# California Univ., Berkeley. Lawrence Berkeley Lab.
SEARCH FOR HADRON JETS AND LARGE TRANSVERSE MOMENTUM ELECTRONS AT THE SPS pp COLLIDER
Marcel Banner *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 21-27 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The search of high transverse momentum electrons needs the use of all the different elements of the UA2 detector; therefore the description of this search is a good way to understand the features of the apparatus, and its performance in a collider environment. A preliminary analysis of the UA2 data collected during the last collider run (20 nb integrated luminosity) with particular emphasis on large transverse momentum hadron jets and on electrons having the configuration expected from the decay of electroweak bosons is presented. Author

N84-15914# California Univ., Berkeley. Lawrence Berkeley Lab.
CROSS SECTION ESTIMATES FOR MULTI-TeV PHYSICS
Robert N. Cahn *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 28-29 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

In designing detectors fo the multi-TeV region, it is worthwhile to consider what cross sections might be anticipated on the basis of present experience and theoretical prejudice. Such projections must be treated with a good deal of skepticism since they require very large extrapolations from the ISR-FNAL energy range of slightly lesser extrapolations from the fragmentary SPS Collider data. It should be emphasized that the projections given here are not only very approximate, but furthermore do not represent what is most likely to be interesting at these very high energies. After all, we want to look for new phenomena, not just the standard catalogue of jets, dileptons, and the like. Nevertheless, these mundane items do furnish us with benchmarks, standards for the cross sections which are potentially interesting and perhaps examples of signatures which could help identify truly new physics. Author

N84-15915# California Univ., Berkeley. Lawrence Berkeley Lab.
MONTE CARLO SIMULATION OF HIGH p/SUB P JETS
Frank E. Paige, Serban D. Protopopescu, and Dennis P. Weygand *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 30-39 refs (For primary document see N84-15911 06-72)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A09/MF A01

The properties of hgh p(sub T) jets expected at high energy hadron colliders are discussed. Perturbative QCD predicts that high p/sub T) hadronic reactions should contain jets of hadrons from the fragmentation of quarks and gluons. Evidence for jets with about the predicted cross section was found at the ISR, although the jets are not clearly separated from the background of low p(sub T) particles. At the SPS Collider, the jets stand out dramatically and some clear multijet events are seen. Since jets are expected both from QCD hard scattering and from the decay of heavy particles, we will surely want to study them at any future hadron collider. Author

N84-15916# California Univ., Berkeley. Lawrence Berkeley Lab. Tracking Detectors Working Group.
THE PROBLEM OF TRACKING CHARGED PARTICLES IN THE CORES OF HIGH ENERGY JETS IN A HIGH RATE ENVIRONMENT
Donald Hartill, M. Atac, W. Bartel, M. Breidenbach, A. Bross, W. Carithers, E. Gatti, D. Greiner, D. Herrup, and B. Kephart *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 43-48 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The problem of tracking charged particles in the cores of high energy jets in a high rate environment is a difficult one. The tracking group concentrated on three problems to provide a focus for the effort. These were (1) the general vertex detector, (2) the central and forward regions for 1 TeV pp collider with a luminosity of 1x10 to the 33rd power square cm sec, and (3) possible tracking devices for a 20 TeV hadron hadron collider. Author

N84-15917# California Univ., Berkeley. Lawrence Berkeley Lab. Calorimetry Working Group.
REVIEW OF PROPERTIES OF VARIOUS TYPES OF CALORIMETERS: HIGH LUMINOSITY AND HIGH ENERGY
Barnard Pope, C. Baltay, L. Camilleri, B. Cox, M. Eaton, G. Finocchiaro, M. Franklin, M. Gilchriese, H. Gordon, and R. Gustafson *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 49-57 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Properties of various types of calorimeters with special attention being paid to the challenges of high luminosity and high energy were reviewed. A number of approaches were perceived: performance properties of calorimeters, the physics requirements, and various types of calorimeters. The approaches were divided into four areas (continuous calorimeters, scintillation sampling, gas sampling, and liquid sampling calorimeters). Some limiting factors involved in experiments at high luminosities (or at high energies) were explored. Examples were offered. Specific areas where substantial research and development are needed were itemized. B.G.

N84-15918# California Univ., Berkeley. Lawrence Berkeley Lab. Triggers Working Group.
TRIGGER SYSTEMS WHICH COULD OPERATE AT A LUMINOSITY OF 10/SUP 33 CM(-2) TO SEC/SUP -1
Mel Shochet, T. Carroll, W. Hoogland, R. Johnson, R. Kass, J. Linneman, S. Loken, R. Majka, M. Ronan, and M. Tannenbaum *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 58-61 (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The possibility of a trigger system which could operate at a luminosity of 1x10 to the 33rd power/square cm sec was examined. Two luminosity related problems were stressed: the fast trigger decisions which must be made because of the high interaction rate, and the effect of multiple interactions within the integration time of the detector. The system presented while not necessarily optimal will work. It is a multi-level trigger system, where the number of events which are retained at any level is only limited by the requirement that the deadtime at the next level not be excessive. Before describing the overall system, multiple event pile up, tracking, electron identification and transverse momentum imbalance are described. B.G.

N84-15919# California Univ., Berkeley. Lawrence Berkeley Lab. Particle Identification Working Group.
SEARCHING FOR LIMITATIONS IN CAPABILITY DUE TO HIGH AVERAGE RATES
David R. Nygren, S. Aronson, J. Bensinger, C. Y. Chang, M. Goldberg, M. Holder, R. Kofler, D. Leith, E. Loh, and P. Nemethy *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 62-63 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Limitations in capability due to high average rates was addressed. The luminosity taken for reference was 1 x 10 to the 33rd power. Rates were in some instances rather modest, arising from the high degree of segmentation needed a priori to swallow the high multiplicity jets expected, and evident now at the SPS collider. Topics receiving attention included the following array of possibilities: Cerenkov ring imaging, transition radiation, synchrotron radiation, time of flight, and heavy quark tagging with leptons. B.G.

N84-15920# California Univ., Berkeley. Lawrence Berkeley Lab. Detector Systems Working Group.
DETECTORS AT 20 TeV AND DETECTOR CONSIDERATIONS

FOR A HIGH LUMINOSITY HADRON-HADRON MACHINE
Barry C. Barish, J. Appel, J. Branson, R. Cahn, R. Carroll, J. Christenson, B. Diebold, H. Gordon, W. Hoogland, and R. Johnson *In its* Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 64-72 (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

There are many systems considerations involved in large particle detectors. Two areas were selected: (1) detectors at 20 TeV and (2) detector considerations for a high luminosity hadron-hadron machine. Author

N84-15921# Brookhaven National Lab., Upton, N. Y.
TRACK CHAMBERS FOR HIGH LUMINOSITY
T. Ludlam and E. D. Platner *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 75-80 refs (For primary document see N84-15911 06-72)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A09/MF A01

The requirements for chambers as large solid angle tracking devices in a hadron collider at L 10 to the 33rd power sq cm/sec are examined. This luminosity corresponds to an event rate of 50 GHz, and an average charged particle density dm/dy -3.6 is assumed. The known performance of the axial field spectrometer drift chamber and the MPS 2 drift chamber system are taken as a starting point. The rate per wire should not exceed 2 MHz. The sensitive time of the chambers (i.e., maximum drift times) should be short enough to limit the coverage number of pile up events to not more than a few. Author

N84-15922# California Univ., Los Angeles.
THE PERFORMANCE OF 16000 WIRE MINI-DRIFT MWPC SYSTEM
P. Chauvat, R. Cousins, K. Hayes, A. M. Smith, R. Bonino, J. Ellett, M. Medinnis, A. Russ, P. E. Schlein, and B. Alitti *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 81-87 Prepared in cooperation with CERN, Geneva and CEA, Gif-sur-Yvette (France) (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

A Mini-Drift chamber system and associated electronics employed are described. The performance of the system which utilizes 3mm spacing multi-wire proportional chambers produces a spatial resolution of sigma = 180 microns under experimental conditions. R.J.F.

N84-15923# Fermi National Accelerator Lab., Batavia, Ill.
BREAKDOWN PROCESSES IN WIRE CHAMBERS, PREVENTION AND RATE CAPABILITY
M. Atac *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 88-96 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Breakdowns were optically and electronically observed in drift tubes and drift chambers. They occur at a critical gain for given intensity in a gas mixture when ultraviolet photons are not completely quenched. It was observed that the breakdowns depended critically on average current for a given gas mixture independent of the size of the drift tubes used. Using 4.6% ethyl alcohol vapor mixed into 50/50 argon ethane gas, breakdowns are eliminated up to 7 microns A average current drawn by pulses on a 1 cm section of an anode wire under an intense source. Pulses with an avalanche size of one million electron rates above one million pulses per centimeter per wire may be obtained with the elimination of breakdowns. R.J.F.

N84-15924# California Univ., Berkeley. Lawrence Berkeley Lab.
THE CONCEPT OF A SOLID STATE DIRECT CHAMBER
E. Gatti (Politecnico di Milano) and P. Rehak *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 97-98 ref (For primary document see N84-15911 06-72)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A09/MF A01

The Solid State Drift Chamber (SSDCH), a thin wafer of a high purity n-type silicon (few square cm x a few hundreds microns thick) with a single small-area, small-capacitance anode readout is discussed. The drift voltage is supplied to an array of drift electrodes on both sides of the wafer to produce a uniform drift field parallel to the surface of the wafer and to ensure the completion of the water. R.J.F.

N84-15925# California Univ., Berkeley. Lawrence Berkeley Lab.
LARGE AREA NON-CRYSTALLINE SEMICONDUCTOR DETECTORS **c76**
V. Perez-Mendez, T. Mulera, S. N. Kaplan, and P. Wiedenbeck *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 99-100 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The properties of various non-crystalline semiconductors are considered for use as position sensitive detectors. Amorphous silicon and conducting plastic can be doped to form P-N depletion regions similar to those in single crystal silicon, but without the limitation of single crystal size. Chalcogenide glassy materials such as Te-Se-Ge compounds as well as some metallic oxides such as the Vanadium oxides have switching and memory properties. They could serve as x,y location identifying devices when triggered by amplified pulses from a parallel plate or multistep gas filled detector stage in order to resolve the multitrack ambiguity for x,y readout schemes. R.J.F.

N84-15926# Brookhaven National Lab., Upton, N. Y.
THE DESIGN AND EXPECTED PERFORMANCE OF A FAST SCINTILLATOR HADRON CALORIMETER
R. B. Palmer and A. K. Ghosh *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 101-105 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

A calorimeter of the type developed by W. Willis, et al., is discussed. The calorimeter consists of a stack of alternating metal (copper or uranium) and scintillator plates 20 cm wide, 120 cm long and 1.5 mm thick. A typical pulse from the 807 calorimeter was generated by 4 GeV electrons but the pulses from hadrons and at different energies are not significantly different. The width and shape of this pulse comes from the convolution of a number of sources. The objective of the first phase of the study was to isolate these separate contributions, estimate how they could be speeded up and find what costs are involved. In the second phase an extremely crude calorimeter was constructed whose pulses should have the same characteristic as in a real device. With this signals whose mean width was 7 nsec and whose width at 10% of maximum height was 15 nsec were observed. Clipping could reduce these widths to 6 and 12 nsec respectively. It was concluded that gate times of less than 20 nsec would be appropriate for such a calorimeter. R.J.F.

N84-15927# Michigan Univ., Ann Arbor. Dept. of Physics.
SCINTILLATION CHAMBER OPERATION OF CALORIMETERS FOR COLLIDING BEAM DETECTORS
Lawrence W. Jones *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 106-107 refs Sponsored in part by NSF (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

It is suggested that the scintillation chamber, a technique first discussed almost thirty years ago, might find application in colliding beam detector systems, in particular as a means of efficiently extracting detailed spatial and energy information from a sampling calorimeter. A protype system is discussed. Author

N84-15928# Fermi National Accelerator Lab., Batavia, Ill.
HIGH ENERGY ELECTROMAGNETIC SHOWER POSITION MEASUREMENT BY A FINE GRAINED SCINTILLATION HODOSCOPE
B. Cox, G. Hale, P. O. Mazur, R. L. Wagner, D. E. Wagoner, H. Areti, S. Conetti, P. Lebrun, T. Ryan, and R. A. Gearhart (Stanford Linear Accelerator Center) *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 108-110 refs

Prepared in cooperation with McGill Univ., Montreal (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The centroids of high energy electromagnetic showers initiated by positrons in the energy range 2 to 17.5 GeV were measured with a fine grained scintillation hodoscope composed of seven 1 cm wide elements placed behind a 3.6 radiation length (15 cm) converter composed of SOG1-C acintillation glass. Results of the energy dependence of the shower profiles and the ionization measured by this hodoscope are given. R.J.F.

N84-15929# Pennsylvania Univ., Philadelphia. Dept. of Physics.
SCINTILLATORS AND WAVESHIFTERS FOR FAST SCINTILLATOR-WSB CALORIMETRY
George E. Theodosiou *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 111-114 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Some properties of fast scintillators and waveshifters, and their use and limitations in calorimetry using the wavelength shifter bar readout technique are discussed. Cast acrylic and extroded polystyrene scintillators coupled with fast waveshifters are discussed. R.J.F.

N84-15930# Fermi National Accelerator Lab., Batavia, Ill.
A MEASUREMENT OF THE RESPONSE OF AN SCG1-C SCINTILLATION GLASS SHOWER DETECTOR TO 2-17.5 GeV POSITRONS
B. Cox, G. Hale, P. O. Mazur, R. L. Wagner, D. E. Wagoner, H. Areti, S. Conetti, P. Lebrun, T. Ryan, J. E. Brau (Stanford Linear Accelerator Center) et al *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 115-118 refs Prepared in cooperation with McGill Univ., Montreal (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The response of an electromagnetic shower counter constructed from the new scintillation glass (SCG1-C, Ohara Optical Glass, Inc.) to positrons in the energy range 2 to 17.5 GeV was measured. The energy resolution of this 18.4 radiation length detector plus its attendant SF5 lead glass shower counter array was measured to be sigma/E = (1.64 plus or minus 0.14)% + (1.13 plus or minus 0.33)%/, square root of E with the constant term dominated by variations in the conversion point of the positron and shower leakage. This counter was found to be linear over the energy range examined. Also measured was the light output of the SCG1-C counter relative to light output of the SF5 lead glass guard blocks using 17.5 GeV positrons. It was found that the sOG1-C counter produces 5.10 plus or minus 0.30 more light at the phototube than the SF5 lead glass counters. R.J.F.

N84-15931# Pennsylvania Univ., Philadelphia. Dept. of Physics.
CALORIMETRY AT L = 10/SUP 33
W. Selove and G. Theodosiou *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 119-121 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Existing scintillation calorimetry techniques make operation at collision rates of 10 to the 8th power sec feasible for most rare events are shown. The pp colliders at L = 10 to the 33rd power, with DC operation are analyzed. Possible misleading effects due to pile up are discussed. E.A.K.

N84-15932# Brookhaven National Lab., Upton, N. Y.
TRIGGERING AT HIGH LUMINOSITY: FAKE TRIGGERS FROM PILE-UP
Randy Johnson *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 122-124 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Triggers based on a cut in transverse momentum have proved to be useful in high energy physics both because they indicate that a hard constituent scattering has occurred and because they can be made quickly enough to gate electronics. The usefulness of these triggers at high luminosities if overlapping events do not cause an excessive number of fake triggers is determined. E.A.K.

N84-15933# Brookhaven National Lab., Upton, N. Y.
FAST ASYNCHRONOUS LEVEL 1 PRE-TRIGGER FOR ELECTRONS AT L = 10/SUP 33 CM-2 SEC-1
Michael J. Tannenbaum *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 125-126 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Asynchronous Triggers which have long been used at fixed target accelerators and the CW High Luminosity CERM ISR are discussed. Bunched beam colliders tend to use triggers which are synchronized with the time of the beam crossing. The CDF trigger scheme has 3.5 micro psec between such crossings to decide whether to further process any events which occurred during the crossing. The level 1 trigger can accept a rate of 50 kHz without appreciable dead time. The level 2 trigger uses fast bit slice processors to select event topologies in 10 micro sec and thus can accept a trigger rate of 5 KHz. Readout of the system which takes 1/2 msec is required for level 3, thus limiting the triggering rate at level 3 to approximately 100 Hz. It is shown that this same trigger scheme would work at a CW luminosity of 10 to the 33th power sq cm sec to -1 power by the addition of a conventional hard wired asynchronous pretrigger. E.A.K.

N84-15934# Syracuse Univ., N. Y.
PROSPECTS FOR CERENKOV RING IMAGING AT HADRON COLLIDERS
Marvin Goldberg (Stanford Linear Accelerator Center) and David W. G. S. Leith *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 127-131 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The developing techniques of Cerenkov ring imaging detectors are reviewed. Their performance in high luminosity environments is emphasized. E.A.K.

N84-15935# Brookhaven National Lab., Upton, N. Y.
USE OF SYNCHROTRON RADIATION FOR ELECTRON IDENTIFICATION AT HIGH LUMINOSITY
S. Aronson *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 132-133 refs (For primary document see N84-15911 06-72)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A09/MF A01

Synchrotron radiation was used to identify electrons of 10 to 30 GeV traversing a field length of 30 kG-m. Comparable field lengths are a feature of many proposed collider detectors, which is an electron energy range of interest at r s = 1 TeV. The usefulness of such a device in the L = 10 to the 33th power environment is considered. E.A.K.

N84-15936# Maryland Univ., College Park.
TOF FOR HEAVY STABLE PARTICLE IDENTIFICATION
C. Y. Chang *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 134-136 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Heavy stable particle production in a new energy region of hadron-hadron collisions was investigated. The existence of stable heavy leptons or any massive hadronic system carrying new quantum numbers is indicated. Experimentally, evidence of its production has not been found for PP collisions either at FNAL2,3 or at the CERN ISR4 for the square root of S = 23 and 62 GeV respectively. However, many theories beyond the standard model predict its existence on a mass scale ranging from 50 to a few hundred GeV, which would make a high luminosity TeV collider an extremely ideal hunting ground for seaching the production of such a speculated object. E.A.K.

N84-15937# Brookhaven National Lab., Upton, N. Y.
OPERATION OF A HIGH-P/SUB T SPECTROMETER ARM AT

10/SUP 33 CM-2 SEC-1 WITH PRATICLE IDENTIFICATION
S. Aronson, M. Goldberg (Syracuse Univ.), M. Holder (Siegen Univ.), and E. Loh (Utah Univ.) *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 137-139 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

A high-PT spectrometer pair as a prototype high luminosity experiment was presented. An updated version of this apparatus is considered with the following questions: (1) Rate capabilities required to cope with L = 10 to the 33rd power sq cm sec -1; (2) segmentation needed to deal with the particle densities expected in high PT jets; (3) is the resulting device within the reach of present technology. The current version of the device and the expected rates is presented. The rates an the segmentation of the components and the results of calculations related to event pile up and triggering are discussed. It is concluded that particle identification is feasible at these rates. E.A.K.

N84-15938# Argonne National Lab., Ill.
MUONS AND ELECTRONS IN GENERAL
L. Nodulman and J. Bensinger (Brandeis Univ.) *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 140-141 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

Simultaneously identification electrons and muons in a general purpose detector at a luminosity of 10 33 cm -2 sec -1 was addressed. The signatures of new effects to be found at high rates are not well predicted, and it may be necessary to look simultaneously for some combination of jets, missing Et, electrons, and muons. This leads to an open geometry with magnetic tracking and calorimetry. At high luminosity which gets trigger information quickly is a prime concern. If a given signature requires isolating individual events then even for an optimistic integration time of 20 ns, the optimal luminos:ty is about 2 x 10 32 cm -2 sec -1. E.A.K.

N84-15939# Brookhaven National Lab., Upton, N. Y.
DETECTING HEAVY QUARK JETS
G. Benenson, L. L. Chau, T. Ludlam, F. E. Paige, E. D. Platner, S. D. Protopopescu, and P. Pehak *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 143-156 refs (For primary document see N84-15911 06-72)
(Contract DE-AC02-76CH-00016)
Avail: NTIS HC A09/MF A01

The performance of a detector specifically configured to tag heavy quark (HO) jets through direct observations of D-meson decays with a high resolution vertex detector was examined. To optimize the performance of such a detector, we assume the small diamond beam crossing configuration as described in the 1978 ISABELLE proposal, which gives a luminosity of 10(32) cm(+2) sec(+1). Because of the very large backgrounds from light quark (LQ) jets, most triggering schemes at this luminosity require high P/sub perpendicular to/leptons and inevitably give mission. E.A.K.

N84-15940# Argonne National Lab., Ill.
ANGULAR COVERAGE OF DETECTORS
R. Diebold *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 157-158 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

The total rapidity range at high energy pp and pp colliders is very large is discussed. Heavy particles tend to give decay products at much larger angles, how to optimize the general purpose '4' detector and where fine segmentation is most likely to be of use in getting out important new physics is outlined. E.A.K.

N84-15941*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL ELECTRON HEATING RATE: A DERIVATION
Walter R. Hoegy Nov. 1983 43 p refs Submitted for publication
(NASA-TM-85124; NAS 1.15:85124) Avail: NTIS HC A03/MF A01 CSCL 20H

The thermal electron heating rate is an important heat source term in the ionospheric electron energy balance equation, representing heating by photoelectrons or by precipitating higher energy electrons. A formula for the thermal electron heating rate is derived from the kinetic equation using the electron-electron collision operator as given by the unified theory of Kihara and Aono. This collision operator includes collective interactions to produce a finite collision operator with an exact Coulomb logarithm term. The derived heating rate O(e) is the sum of three terms, O(e) = O(p) + S + O(int), which are respectively: (1) primary electron production term giving the heating from newly created electrons that have not yet suffered collisions with the ambient electrons; (2) a heating term evaluated on the energy surface m(e)/2 = E(T) at the transition between Maxwellian and tail electrons at E(T); and (3) the integral term representing heating of Maxwellian electrons by energetic tail electrons at energies > ET. Published ionospheric electron temperature studies used only the integral term O(int) with differing lower integration limits. Use of the incomplete heating rate could lead to erroneous conclusions regarding electron heat balance, since O(e) is greater than O(int) by as much as a factor of two. M.G.

N84-15942# Rochester Univ., N. Y. Dept. of Chemistry.
EMISSION OF SHORT-WAVELENGTH PHOTONS FROM ION-SURFACE CHARGE EXCHANGE
Hai-Woong Lee and Thomas F. George Aug. 1983 16 p
(Contract N00014-80-C-0472)
(AD-A133183; TR-38) Avail: NTIS HC A02/MF A01 CSCL 20/12

The intensity of radiation emitted from ion-surface charge-exchange processes can be significantly enhanced if the surface exposed to impinging ions is electronically excited. Alpha particles capturing electrons at a silicon surface are considered as a possible candidate for a short-wavelength laser. GRA

N84-15943# IRT Corp., San Diego, Calif.
EXPERIMENTAL STUDIES OF SECONDARY ION EMISSION FROM WELL-CHARACTERIZED SURFACES Interim Report
R. L. Palmer May 1983 25 p
(Contract F49620-81-C-0013; AF Proj. 2301)
(AD-A133186; IRT-8213-002; AFOSR-83-0747TR) Avail: NTIS HC A02/MF A01 CSCL 20/8

The emission of ions from surfaces has been investigated using a specially constructed secondary-ion mass and energy analyzer. The energy spectra of H-(D-) and H+(D+) secondary ions produced by the impact of energetic incident ions such as H+, H2+, H3+, Ar+, and He+ on polycrystalline molybdenum foil and single crystal W(110) have been measured. The secondary energy spectra and yield are relatively insensitive to the ion type and energy, but very sensitive to the physical-chemical state of the surface. In particular, the addition of cesium increases the negative ion yield of molybdenum and tungsten by several orders of magnitude as well as shifting the energy distribution to lower energies. The spontaneous emission of H- from W(110) was observed in an ambient of cesium vapor and hydrogen at temperatures above 600 K. The mechanism in this case appears to be surface chemi-ionization. The energy spectrum for this process is similar to that resulting from ion impact at low energies, but the surface chemi-ionization spectrum lacks the higher energy tail (E is less than 10 eV) characteristic of secondary ion emission. GRA

N84-15944# Wisconsin Univ., Madison.
DIFFRACTION TECHNIQUES
M. G. Lagally 30 Aug. 1983 62 p
(Contract N00014-81-K-0718)
(AD-A133254; TR-7) Avail: NTIS HC A04/MF A01 CSCL 20/8

Contents: Introduction; Elements of Diffraction Theory; The Measurement of Diffracted-Intensity Distributions; Surface Crystallography Measurements; Instrumentation and Sample Preparation; Representative Experimental Results; and Conclusions. GRA

N84-15945# Naval Research Lab., Washington, D. C. Beam Dynamics Group.
DYNAMICS OF A HIGH CURRENT ELECTRON RING IN A CONVENTIONAL BETATRON ACCELERATOR Interim Report
C. A. Kapetanakos, S. J. Marsh (Sachs/Freeman Assoc.), and P. Sprangle 14 Sep. 1983 41 p
(RR0110941)
(AD-A133291; NRL-MR-5108) Avail: NTIS HC A03/MF A01 CSCL 20/7

Analytical and computer simulation results are reported on the dynamics of a high current electron ring in a conventional betatron accelerator. These studies include, in addition to the external and self fields, the effects of surrounding walls and toroidal corrections. Results show that, in contrast with the modified betatron, the equilibrium in a conventional betatron is incompatible with either large thermal energy spread or emittance. However, as in the modified betatron, the energy mismatch and the diffusion of the self magnetic field impose stringent constraints on the accelerator. Finally, in both devices, it is necessary to keep the ratio of the ring to the torus minor radii much less than unity.
Author (GRA)

N84-15946# Mission Research Corp., Albuquerque, N. Mex.
BEAM PROPAGATION EXPERIMENTAL STUDY Final Report
R. J. Adler, G. F. Kiuttu, B. A. Sabol, W. Bostick, C. A. Ekdahl, L. A. Wright, B. B. Godfrey, T. P. Hughes, N. F. Roderick, and D. J. Sullivan Apr. 1983 295 p
(Contract F49620-81-C-0016; AF Proj. 2301)
(AD-A133310; AMRC-R-466; AFOSR-83-0743TR) Avail: NTIS HC A13/MF A01 CSCL 20/7

A program of extensively diagnosed experiments to investigate the physics of intense relativistic electron beam propagation in air has been performed using beam generators at the Air Force Weapons Laboratory. The primary objectives of his research were to measure the rate of erosion of the head of the beam, and to investigate resistive instabilities, such as the hose and hollowing modes, that limit the transport of beam energy over significant distances. GRA

N84-15947# Naval Research Lab., Washington, D. C. Plasma Theory Branch.
BEAM CURRENT LIMITATIONS DUE TO INSTABILITIES IN MODIFIED AND CONVENTIONAL BETATRONS
P. Sprangle and D. Chernin 23 Sep. 1983 21 p
(RR011094E)
(AD-A133337; AD-E950445; NRL-MR-5176) Avail: NTIS HC A02/MF A01 CSCL 20/7

Current thresholds for longitudinal and transverse instabilities are calculated for beams of specified dimensions in conventional and modified betatrons, using simple models for the longitudinal and transverse impedances. Self field effects of the beam are included and lead to a novel, competitive effect between the stabilization mechanism and instability growth. This competition results in a multi-valueness in the limiting current vs beam energy spread plot even for conventional betatrons. Accessibility of the various limiting current levels appears to depend upon the rate of beam injection. The stabilizing effects of betatron oscillations are discussed and written as the sum of three physically interpretable contributions to an effective energy spread. We find that the presence of a strong toroidal field can significantly improve the current carrying capacity of the accelerator. GRA

N84-15948# Naval Research Lab., Washington, D. C. Geophysical and Plasma Dynamics Branch.
FINITE GEOMETRY EFFECTS ON THE STABILITY OF A CHARGED BEAM PROPAGATING THROUGH A RELATIVISTIC ANNULAR ELECTRON BEAM
G. Ganguli (Science Applications, Inc., McLean, Va.) and P. Palmadesso 28 Sep. 1983 23 p
(RR0330244)
(AD-A133338; AD-E950445; NRL-MR-5191) Avail: NTIS HC A02/MF A01 CSCL 20/7

Finite geometry effects on the stability properties of a charged beam propagating through an intense relativistic annular electron beam has been studied. The stability of the system under transverse oscillation has been examined in detail in a parameter domain pertinent to the Collective Particle Accelerator, current under development at the Naval Research Laboratory. Both the normal mode and the convective aspects of this instability have been investigated. Despite a substantial temporal growth rate as predicted by the normal mode approach this instability does not prevent successful acceleration of a portion of the axial beam. Thus the transverse oscillation is not fatal to the CPA operation.
Author (GRA)

N84-15949# Washington Univ., Seattle.
AVERAGE VIBRATIONAL ENERGY TRANSFER DURING A SINGLE COLLISION OF EXCITED MOLECULES WITH HEAT BATH MOLECULES
I. Oref and B. S. Rabinovitch 1 Oct. 1983 35 p
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A133391; AD-E950446; NR092-549-TR28) Avail: NTIS HC A03/MF A01 CSCL 07/4

A statistical collisional energy transfer probability related to Boltzmann forms is assumed. Single collisions between vibrationally excited substrate molecules with heat bath molecules are considered. The dependence of the average energy per collision transferred up, down and overall on the initial energy content, on the temperature and on the size of the bath and substrate molecules is calculated and compared with data in the literature.
Author (GRA)

N84-15950# Cornell Univ., Ithaca, N.Y.
INTERACTIONS OF VIBRATIONALLY EXCITED MOLECULES WITH SOLID SURFACES Final Report
Paul L. Houston and R. P. Merrill 9 Sep. 1983 28 p
(Contract DAAG29-80-K-0020)
(AD-A133449; ARO-17349.2-CH) Avail: NTIS HC A03/MF A01 CSCL 07/4

The interaction of gas-phase molecules with solid surfaces is of importance to heterogeneous catalysis, corrosion, air filtration, pollution control, and chemical deactivation. Our research group has recently obtained some of the first direct measurements of the probability for vibrational deactivation during gas-solid collisions. A pulsed infrared laser is used to excite CO of CO2 vibrationally under conditions where the predominant cause of deactivation is due to the gas-surface collision. The probability of relaxation is then monitored by observing the time-dependent decay of infrared fluorescence from the excited molecules. Results for CO2 (001) show that the deactivation probability is 0.22 for collisions with a stainless steel surface, 0.16 for silver, and 0.20 for nickel. GRA

N84-15951# Indiana Univ., Bloomington. Dept. of Chemistry.
THEORETICAL AND EXPERIMENTAL STUDIES OF THE ELECTRONIC STRUCTURE OF THE MO3(MICRO3-0)(MICRO3-OR)(MICRO-OR)3(OR)6 TYPE OF TRIANGULO METAL ATOM CLUSTER COMPOUND
M. H. Chisholm, F. A. Cotton, Anne Fang, and E. C. Kober 8 Sep. 1983 29 p Submitted for publication
(Contract N00014-79-C-0044; NR Proj. 056-703)
(AD-A133516; INDU/DC/TR-83/5-MC) Avail: NTIS HC A03/MF A01 CSCL 07/4

The electronic structure of a Mo3(Mu sub 3-0) (Mu sub 3-OR) (Mu sub 2-OR)3(OR)6 molecule with R = H, and C3v symmetry, which serves as a model for real molecules in which R = H CH2C(CH)3 or CH(CH3)2 has been calculated by the molecular orbital method of Hall and Fenske. The calculations have been performed not only on the entire molecule, but on the Mo3(12+), Mo3O(OH)(9+) and Mo3O(OH)4(6+) fragments and the metal-metal bonding tracked through these successive stages by the "clusters in molecules' formalism. In the full molecule, the HOMO is an e orbital that carries most of the e-type M-M bonding, while the a1-type is carried by two MO's, one of which is quite stable. The LUMO is also an e type orbital and the HOMO-LUMO gap is small (ca. 1.5 eV). It is predicted that the Mo3O(OR)10 molecules of this type will have readily accessible redox chemistry in which

both oxidation and reduction steps might be slowed or irreversible judging by the character of the HOMO and LUMO of the Mo3O(OR) 10 molecule. Experimental observations on Mo3O(ONe)10, Ne = CH2C(CH3)3, are in harmony with this. In addition, the absorption spectrum of Mo3O(ONe)10 has been observed and an assignment based on the calculations in proposed. GRA

N84-15952# Wisconsin Univ., Madison.
STATE-TO-STATE UNIMOLECULAR REACTION DYNAMICS Technical Progress Report
1983 5 p refs
(DE84-003009; DOE/ER-10755/3) Avail: NTIS HC A02/MF A01

Unimolecular reaction dynamics using direct excitation of overtone vibrations in combination with time resolved spectroscopic product detection were studied. Unimolecular decomposition rates and energy disposal into the fragments of selectively excited molecules are outlined. A pulsed molecular beam apparatus for extending these measurements to cold molecules was tested. Laser induced fluorescence detection to measure the unimolecular decay rate in selectively excited t-butylhydroperoxide and to determine the product quantum states populated in the decomposition of hydrogen peroxide and its partially deuterated analogue are employed. DOE

N84-15953# Brandeis Univ., Waltham, Mass. Dept. of Physics.
DIFFERENCES BETWEEN POSITRONS AND ELECTRONS IN ELASTIC AND INELASTIC PROCESSES AT SURFACES
K. F. Canter and K. G. Lynn (Brookhaven National Lab.) Sep. 1983 23 p refs Presented at the Am. Vacuum Soc. Meeting, Boston, 1 Nov. 1983
(Contract DE-AC02-76CH-00016)
(DE84-001208; BNL-33685; CONF-831171-13) Avail: NTIS HC A02/MF A01

The elastic scattering of positrons of 30 to 300 eV differs significantly from electrons, i.e., a lack of an exchange interaction and ion core repulsion, instead of attraction. Inelastic scattering also differs because there are no final scattering states for the positron which are excluded by the Pauli principle, thus resulting in a shorter positron elastic mean free path. The resulting advantages of LEPD over LEED are discussed. When a positron is implanted and thermalizes in a solid, many possible fates occur which differs from electrons. The dominant processes for positrons occurring at a metallic surface are: (1) localization in a surface state: and (2) direct reemission from the metal into the vacuum in those systems which exhibit a negative positron work function, during this reemission process the positrons can loose energy by exciting molecular vibrations; (3) reemission into the vacuum with an electron, thus forming positronium. DOE

N84-15954# Washington Univ., Seattle. Dept. of Physics.
GIANT DIPOLE RESONANCES BUILT ON EXCITED STATES
Kurt A. Snover 1983 32 p refs Presented at the Intern. Symp. on Highly Excited States and Nucl. Struct., Orsay, France, 5 Sep. 1983
(Contract DE-AC06-81ER-40048)
(DE84-001549; DOE/ER-40048/73-L3; CONF-830970-3; CONF-8309169-1) Avail: NTIS HC A03/MF A01

The properties of giant dipole resonances built on excited nuclear states are reviewed. Nonstatistical (p,(BETA)) reactions in light nuclei, and statistical complex particle reactions in light and heavy nuclei are discussed. DOE

N84-15955# Stanford Linear Accelerator Center, Calif.
A 650 MM LONG LIQUID HYDROGEN TARGET FOR USE IN A HIGH INTENSITY ELECTRON BEAM
John W. Mark Jul. 1983 8 p refs Presented at the Cryogenic Eng. Conf. and the Intern. Cryogenic Mater. Conf., Colorado Springs, 11-19 Aug. 1983
(Contract DE-AC03-76SF-00515)
(DE84-002552; SU-SLAC-PUB-3169; CONF-830841-27) Avail: NTIS HC A02/MF A01

A 650 mm long liquid hydrogen target constructed for use in the high intensity electron beam at the Stanford Linear Accelerator Center was described. The main design problem was to construct a target that would permit the heat deposited by the electron beam to be removed rapidly without boiling the hydrogen so as to maintain constant target density for optimum data taking. Design requirements, construction details and operating experience are discussed. DOE

N84-15956# Argonne National Lab., Ill.
PHOTOELECTRON STUDIES OF RESONANT MULTIPHOTON IONIZATION OF CO VIA THE A-1 PI STATE
S. T. Pratt, E. D. Poliakoff, P. M. Dehmer, and J. L. Dehmer 1983 35 p refs Presented at the 13th Intern. Conf. on the Phys. of Electron. and Atomic Collisions (ICPEAC), Berlin, West Germany, 27 Jul. 1983
(Contract W-31-109-eng-38)
(DE83-008535; CONF-830706-1) Avail: NTIS HC A03/MF A01

Measurements of multiphoton ionization of CO involving a three photon resonance to the v=1-3 levels of the CO A (1)PI state followed by the absorption of either two (v=3) or three (v=1,2) additional photons to reach the ionization continual are reported. In one measurement, the CO(+) ion intensity is measured as a function of wavelength, yielding the rotational structure of the intermediate resonant state. In a second measurement, the laser frequency is set at the v=1-3 bandheads, and the kinetic energy spectra of the ejected electrons are measured. The observed vibrational branching ratios in these photoelectron spectra do not follow the pattern predicted by the Franck-Condon overlap between the A (1)PI intermediate state and the ionization continue. Several possible causes for this (not unexpected) deviation from Franck-Condon behavior are discussed. DOE

N84-16041*# University of Eastern Kentucky, Richmond. Dept. of Physics and Astronomy.
STUDIES OF NEUTRON AND PROTON NUCLEAR ACTIVATION IN LOW-EARTH ORBIT 2
C. E. Laird *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 25 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20H

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N84-15957*# Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Materials and Technology Lab.
INVESTIGATION OF A PARA-ORTHO HYDROGEN REACTOR FOR APPLICATION TO SPACECRAFT SENSOR COOLING Final Report
T. C. Nast Jan. 1983 49 p refs
(Contract NAS5-25792)
(NASA-CR-175131; NAS 1.26:175131; LMSC-D877499) Avail: NTIS HC A03/MF A01 CSCL 18L

The utilization of solid hydrogen in space for sensor and instrument cooling is a very efficient technique for long term cooling or for cooling at high heat rates. The solid hydrogen can provide temperatures as low as 7 to 8 K to instruments. Vapor cooling is utilized to reduce parasitic heat inputs to the 7 to 8 K stage and is effective in providing intermediate cooling for instrument components operating at higher temperatures. The use of solid hydrogen in place of helium may lead to weight reductions as large as a factor of ten and an attendent reduction in system volume. The results of an investigation of a catalytic reactor for use with a solid hydrogen cooling system is presented. Trade studies were performed on several configurations of reactor to meet the requirements of high reactor efficiency with low pressure drop. Results for the selected reactor design are presented for both liquid hydrogen systems operating at near atmospheric

pressure and the solid hydrogen cooler operating as low as 1 torr. Author

N84-15489# Societe Belge pour l'Industrie Nucleaire, Brussels (Belgium).
SINGLE PHASE SODIUM FLOW IN COMPLEX AND DEFORMED GENERATORS
P. Kunsch *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 1 1983 42 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

N84-15492# Joint Research Centre of the European Communities, Ispra (Italy).
LIQUID METAL EXPERIMENTAL FACILITIES
H. M. Kottowski *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics in Liquid Metals, Vol. 1 1983 49 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

N84-15493# Centre National de la Recherche Scientifique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDIES ON SODIUM BOILING PHENOMENA IN OUT OF PILE ROD BUNDLES FOR VARIOUS ACCIDENTAL SITUATIONS IN LIQUID METAL FAST BREEDER REACTORS (LMFBR) EXPERIMENTS AND INTERPRETATIONS
J. M. Seiler and B. Rameau *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 1 1983 38 p refs (For primary document see N84-15487 06-34)
Avail: NTIS HC A14/MF A01

N84-15496# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
SODIUM BOILING EXPERIMENTS IN BUNDLE GEOMETRIES UNDER FAST TRANSIENT AND STEADY STATE CONDITIONS
F. W. Peppler *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 45 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

N84-15497# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
THE BLOW-3A: A THEORETICAL MODEL TO DESCRIBE TRANSIENT TWO PHASE FLOW CONDITIONS IN LIQUID METAL FAST BREEDER REACTOR (LMFBR) COOLANT CHANNELS
M. Bottoni and D. Struwe *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 61 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

N84-15498# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
THEORETICAL SIMULATION OF THERMOHYDRAULIC BEHAVIOR OF SODIUM COOLED SUBASSEMBLIES IN STEADY STATE AND TRANSIENT CONDITIONS
M. Bottoni and D. Struwe *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 74 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

N84-15499# Centre National de la Recherche Scientifique, Grenoble (France). Centre d'Etudes Nucleaires.
COMPUTATION OF THE THERMOHYDRAULICS IN SUBASSEMBLIES FOR ACCIDENT SITUATIONS
G. Basque *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 34 p refs (For primary document see N84-15494 06-34)
Avail: NTIS HC A15/MF A01

N84-15500# United Kingdom Atomic Energy Authority, Culham (England).
THERMOHYDRAULICS OF LMFBR CORE CATCHERS
B. D. Turland *In* Von Karman Inst. for Fluid Dynamics Thermohydraulics of Liquid Metals, Vol. 2 1983 43 p refs (For primary document see N84-15494 06-34)
(Contract C93/293)
Avail: NTIS HC A15/MF A01

74 OPTICS

Includes light phenomena.

N84-15958*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMMENT ON THE EXTINCT PARADOX
D. M. LeVine Nov. 1983 19 p refs Submitted for publication (NASA-TM-85113; NAS 1.15:85113) Avail: NTIS HC A02/MF A01 CSCL 20F

The extinction paradox is a contradiction between geometrical optics results which predict that at high frequencies the scattering cross section of an object should equal its geometrical cross section and rigorous scattering theory which shows that at high frequencies the scattering cross section approaches twice the geometrical cross section of the object. Confusion about the reason for this paradox persists today even though the nature of the paradox was correctly identified many years ago by Brillouin. The resolution of the paradox is restated and illustrated with an example, and then the implications to the interpretation of scattering cross sections are identified. M.G.

N84-15959*# Korsch Optics, Inc., Huntsville, Ala.
TECHNICAL SUPPORT FOR AXAF Final Report
Nov. 1983 24 p
(Contract NAS8-34943)
(NASA-CR-170950; NAS 1.26:170950) Avail: NTIS HC A02/MF A01 CSCL 20F

The effects of ray aberrations due to various surface errors on the point image are discussed, and a new method and rationale for optimizing the performance of nested arrays of grazing incidence telescopes is introduced. Author

N84-15960*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTICAL MULTIPLE SAMPLE VACUUM INTEGRATING SPHERE Patent Application
Cyrus L. Butner, inventor (to NASA) Filed 30 Nov. 1983 13 p (NASA-Case-GSC-12849-1; US-Patent-Appl-SN-556481) Avail: NTIS HC A02/MF A01 CSCL 20F

An integrating sphere, comprised of a uniform diffusely reflecting spherical cavity, has mutually transverse input and output ports. A linear sample transport mechanism is secured to the sphere so that the multiple samples can be brought into registration with the input port, one at a time, without having to open or disassemble the apparatus when a change of a sample is desired. A vacuum tight seal provided between the cavity and transport mechanism maintains the integrity of a vacuum generated within the sphere when it is attached to the source of optical energy. The device is utilized, for example, to test the emissive characteristic such as the relative fluorescence quantum efficiency of a dye sample placed in the path of a monochromatic optical energy source coupled to the input port while having a light detector coupled to the output port. NASA

N84-15961# Naval Research Lab., Washington, D. C. Inorganic and Electrochemical Branch.
HEAT-STORAGE MATERIALS FOR IRCM Final Report
John C. Cooper and Dwight D. Lindsay 16 Sep. 1983 11 p
(RR0130644)
(AD-A133110; NRL-MR-5149) Avail: NTIS HC A02/MF A01 CSCL 17/4

The use of heat-storage materials was evaluated for flattening and extending the temperature-time profile of pyrophoric materials as thermal emission sources. Materials with large heats of fusion or large enthalpy changes in reversible chemical reactions would be useable as heat-storage materials. GRA

N84-15962# Defence Research Establishment Valcartier (Quebec).
DETERMINATION OF PARTICLE-SIZE DISTRIBUTION BY MEASURING THE TRANSMISSION OF AN AEROSOL IN SEDIMENTATION
G. Roy Nov. 1982 39 p Transl. into ENGLISH from Rept. no. DREV-R-4278/82 Canada, Nov. 1982 39 p
(AD-A133288; DREV-R-4278/82) Avail: NTIS HC A03/MF A01 CSCL 14/2

The results of a feasibility study for determining aerosol size distribution using the extinction-sedimentation inversion technique are presented. It was found that the height of the dissemination chamber may affect the value of the results. R.J.F.

N84-15963# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF THE ANALYSIS OF THE DISRUPTION OF TRACKING
G. V. Obrezkov and V. D. Razevig 2 Sep. 1983 403 p Transl. into ENGLISH from of the book "Metody Analiza Sryva Slezheniya" Moscow, Sovetskoye Radio Press, 1972 p 1-239
(AD-A133335; AD-E950445; FTD-ID(RS)T-0610-83) Avail: NTIS HC A18/MF A01 CSCL 17/7

Nonlinear servo systems, Markov processes, disruption of tracking in quasi-stationary and time dependent systems, particular characteristics of the disruption of tracking, and analysis of the disruption of tracking with the help of electronic computers are discussed. N.W.

N84-15964# New Mexico State Univ., Las Cruces. Dept. of Physics.
MIE CODE AGAUS 82 Final Report
August Miller Aug. 1983 44 p
(Contract DAAG29-81-D-0100; DA Proj. 1L1-6211-AH-71)
(AD-A133489; ERADCOM/ASL-CR-83-0100-3) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report contains descriptions of the mathematical background and a user's guide for Program AGAUS, a computer code which performs scalar Mie-based calculations of the single-scattering properties of polydisperse spherical aerosols. The principal quantities calculated by AGAUS are extinction, absorption, scattering and backscattering coefficients, and the angular intensity distribution of unpolarized incident radiation. A number of other quantities produced by AGAUS exist and are described in the user's manual portion of this report. AGAUS contains internal coding for seven different analytical size-distribution models and permits entry of an "arbitrary' model as discrete data pairs (radius and relative or absolute number density). Provision is made for combining up to five of the analytic models within a single run and for addition, AGAUS contains internal coding for taking account of the growth of hygroscopic particles with varying relative humidity. GRA

N84-15965# Missouri Univ., Kansas City. Dept. of Physics.
OPTICAL PROPERTIES OF NATURAL MINERALS AND OTHER MATERIALS IN THE 350-50000 CM-1 SPECTRAL REGION Final Report, 15 Jul. 1979 - 31 Dec. 1982
Marvin R. Querry Aug. 1983 383 p
(Contract DAAG29-79-C-0131)
(AD-A133530; ARO-16512.2-GS) Avail: NTIS HC A17/MF A01 CSCL 08/7

Reflectance spectra were measured in the UV, VIS, and/or IR for several natural minerals and for several aqueous solutions of ZnCl2 and H3PO4. Complex refractive indices were determined for most of these materials by applying Kramers-Kronig methods to the reflectance spectra. Powders of some of the natural minerals were pressed in to pellets in order to obtain the reflectance spectra. Gypsum was studied in the crystalline form, the powder-pellet form, and by transmittance spectra through KBr pellets containing minute quantities of gypsum. A method was developed for obtaining complex refractive indices from reflectance spectra of the pellets and transmittance spectra of the powder/KBr pellet. The best specularly reflecting pellets were formed from powders of smaller particle size and with forces of from 14 to 16 tons on the 13 mm dia circular face of the pellet. The complex refractive indices of water were also updated by applying Kramers-Kronig methods to a new composite k spectrum in order to determine the n spectrum. Author (GRA)

N84-15966# North Carolina Coll., Durham. Dept. of Physics.
HIGH PRECISION MATERIAL STUDY AT NEAR MILLIMETER WAVELENGTHS Final Report, 10 Sep. 1980 - 9 Sep. 1983
Jyotsna M. Dutta and C. R. Jones 30 Aug. 1983 33 p
(Grant DAAG29-80-G-0005)
(AD-A133575; ARO-17775.3-PH-H) Avail: NTIS HC A03/MF A01 CSCL 20/6

Various quasi-optical components for effective beam transmission at near millimeter wavelengths have been studied. A double-beam apparatus which may be configured as a Mach-Zehnder interferometer has been assembled for dielectric characterization of materials. Values of optical constants, obtained at a frequency of 245 GHz with an optically pumped laser source, are reported for several low-loss materials. The potential for improvements and increased accuracies are discussed. Author (GRA)

N84-15967# Los Alamos Scientific Lab., N. Mex.
SCATTERING AND ABSORPTION OF LIGHT BY SOOT PARTICLES
Bergen R. Suydam Sep. 1983 15 p
(Contract W-7405-eng-36)
(DE84-002308; LA-9856-MS) Avail: NTIS HC A02/MF A01

The structure of a particle of soot is studied and a model of an average soot particle is considered as a scatterer of light. Upon comparing two quite different models, it is concluded that the model chosen is not sensitive to details and ought therefore to be reliable. Of the total extinction cross section, it was found that about 93 percent arises from absorption and only 7 percent from scattering. This greatly simplifies the calculation of light propagation through a cloud of such particles. DOE

N84-15968# California Univ., Livermore. Lawrence Livermore Lab.
NOVETTE PULSE-POWER-SYSTEM DESCRIPTION
D. G. Gritton, D. J. Christie, R. W. Holloway, B. T. Merritt, J. A. Oicles, K. Whitham, and R. B. Wilcox 1983 7 p refs Presented at the 5th Topical Meeting on Technol. of Fusion Energy, Knoxville, Tenn., 26-28 Apr. 1983
(Contract W-7405-eng-48)
(DE83-018185; UCRL-88995; CONF-830406-111) Avail: NTIS HC A02/MF A01

The pulse power systems for Novette are summerized. The flashlamp power system, the pulsers for the various optical shutters and the pulse power control system are reviewed. DOE

N84-15969# Technische Hogeschool Twente, Enschede (Netherlands).
EDGE- AND CONTOUR DETECTION FOR CORRECTION OF LOW-PASS FILTERED IMAGES
O. A. Lubach Jan. 1982 177 p refs
(PB83-217489; Rept-82-004) Avail: NTIS HC A09/MF A01 CSCL 20F

Methods of extracting data from remote sensing images for correction of spatial low pass filtered image are studied. Basically this is an edge detection problem, since edges in low pass filtered images are degraded. Commonly used edge detectors are not feasible for correction purpose as will be shown. A method for contour and average grey level extraction of monochrome images is introduced and the extracted data are used to correct the low pass filtered images. Parts of the extraction algorithm are developed for on line implementation; therefore, they can be implemented in onboard systems of satellites for data reduction purpose. Author

N84-15309# Eloptro Aanleg van Kentron, Kemptron Park (South Africa).
THE INFLUENCE OF WEAKLY POLARIZED SURFACES ON DIFFERENT KINDS OF THIN LAYER SYSTEMS [DIE INVLOED VAN SWAK GEPOLEERDE OPPERVLAKKE OP VERSKILLENDE DUNLAGIESISTEME]

H. F. B. Minnaar *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 91-97 In AFRIKAANS; ENGLISH summary (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15652# Laboratoire d'Etude des Transmissions Ionospheriques, Cachan (France).
ADAPTIVE PROTECTION OF DETECION SYSTEMS OPERATING BY SPREAD SPECTRUM [PROTECTION ADAPTIVE DES SYSTEMES DE DETECTION FONCIONNANT PAR ETALEMENT DE SPECTRE]
C. Goutelard and A. Joisel *In* AGARD Propagation Factors Affecting Remote Sensing by Radio Waves Aug. 1983 13 p refs In FRENCH; ENGLISH summary (For primary document see N84-15646 06-43)
Avail: NTIS HC A17/MF A01

N84-16035*# North Georgia Coll., Dahlonega. Dept. of Physics.
INTERFACING A TWO-STAGE IMAGE INTENSIFIER TUBE TO AN ECHELLE SPECTROGRAPH
Terry R. Flesch *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 16 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N84-15970 Colorado State Univ., Fort Collins.
CURRENT COLLECTION FROM THE SPACE PLASMA THROUGH DEFECTS IN HIGH VOLTAGE SOLAR ARRAY INSULATION Ph.D. Thesis
Robert Patrick Stillwell 1983 129 p
Avail: Univ. Microfilms Order No. DA8317838

For spacecraft operation in the near earth environment, solar cell arrays constitute the major source of reliable long-term power. Optimization of mass and power efficiency results in a general requirement for high voltage solar arrays. The space plasma environment, though, can result in large currents being collected by exposed solar cells. The solution of a protective covering of transparent insulation is not a complete solution, inasmuch as defects in the insulation result in anomalously large currents being collected through the defects. Tests simulating the electron collection from small defects in an insulation have shown that there are two major collection modes. The first mode involves current enhancement by means of a surface phenomenon involving the surrounding insulator. In the second mode the current collecton is enhanced by vaporization and ionization of the insulator material, in addition to the surface enhancement of the first mode.
Dissert. Abstr.

N84-15971 Fulmer Research Inst. Ltd., Stoke Poges (England).
RADIATION EFFECTS IN THE JOINT EUROPEAN TORUS EXPERIMENT: GUIDELINES FOR PRELIMINARY DESIGN Final Report
Andrew Holmes-Siedle Sep. 1980 320 p refs
(Contract JHO/1033)
(R857/2) Avail: Issuing Activity

Guidelines for predicting the magnitude of radiation effects, and for designing and procuring electronic systems which are tolerant to the maximum levels of radiation expected inside the buildings housing the torus are given. Diodes, bipolar transistors, integrated circuits, MOS devices, JFT transistors, optoelectronic devices, optical fibers, insulators, and transducers and diagnostic instruments are covered. Equipment layout for all areas of the building is covered. Author (ESA)

N84-15972*# TRW Space Technology Labs., Redondo Beach, Calif. Applied Technology Div.
PLASMA WAVE EXPERIMENT FOR THE ISEE-3 MISSION Semiannual Report, 1 Apr. - 30 Sep. 1983
Frederick L. Scarf 9 Nov. 1983 26 p refs Sponsored in part by JPL
(Contracts NAS5-2062; NASw-3690; NASw-3504; NAS5-20682; NAS2-9482)
(NASA-CR-175132; NAS 1.26:175132; Rept-23499-6033-UT.00)
Avail: NTIS HC A03/MF A01 CSCL 20I

Sensitive, high resolution plasma probes for analysis of the distribution functions and plasma wave instruments for measurements of electromagnetic and electrostatic wave modes are commonly flown together to provide information on plasma instabilities and wave particle interactions. Analysis of the data for the ISEE 3 mission is provided. B.G.

N84-15973# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DISSIPATION OF MAGNETIC ENERGY DURING DISRUPTIVE CURRENT TERMINATION
K. Yamazaki and G. L. Schmidt (Princeton Univ.) Sep. 1983 20 p refs
(IPPJ-644) Avail: NTIS HC A02/MF A01

The magnetic coupling during a disruption between the plasma and the various coil systems on the PDX Tokamak was modeled. Using measured coil currents, the model indicates that dissipation of magnetic energy in the plasma equal to 75% of the energy stored in the poloidal field of the plasma current does occur and that coupling between the plasma and the coil systems can reduce such dissipation. In the case of PDX ohmic discharges, bolometric measurements of radiation and charge exchange, integrated over a disruption, account for 90% of the calculated energy dissipation. M.G.

N84-15974# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXTRACTION OF VOLUME PRODUCED H(-) OR D(-) IONS FROM A SHEET PLASMA I
Joshin Uramoto Sep. 1983 49 p refs
(IPPJ-645) Avail: NTIS HC A03/MF A01

A production of high current density H(-) or D(-) ions using a sheet plasma under a low pressure and weak magnetic field, an effective extraction method for H(-) or D(-) ions, and a development to large area D(-) ion source are discussed. Author

N84-15975# Nagoya Univ. (Japan). Dept. of Applied Mathematics and Physics.
NON-STOCHASTIC ACCELERATION OF PROTONS IN THE MAGNETIC NEUTRAL SHEET
Jun-ichi Sakai and Ryo Sugihara (Nagoa Univ.) Sep. 1983 14 p refs
(IPPJ-646) Avail: NTIS HC A02/MF A01

A rapid non-stochastic proton acceleration mechanism by electrostatic waves during substorm activity in the magnetospheric tail is presented to explain the origin of energetic protons (up to Mev). The protons are accelerated normal to the neutral sheet. Near a reconnection point, however, the protons are also accelerated along the sheet by a second step process. Author

N84-15976# Kyoto Univ. (Japan). Dept. of Engineering Science.
COLLISIONAL-RADIATIVE MODEL FOR HELIUM-LIKE IONS: APPLICATION TO INTERMEDIATE-DENSITY PLASMAS
Takashi Fujimoto and Takako Kato (Nagoya Univ.) Sep. 1983 40 p refs
(IPPJ-647) Avail: NTIS HC A03/MF A01

To interpret the emission-line intensities from various plasmas, a collisional-radiative-model program was constructed for helium-like ions. In this model, excitation, de-excitation, ionization and three-body recombination by electron collisions, spontaneous transition, radiative recombination, and dielectronic recombination were included. For these processes most reliable rate coefficients, experimental or theoretical, were employed. A detailed account is given of the program along with the review of the rate coefficients

adopted. As an example of its application measured line intensities reported on theta-pinch plasmas are analyzed; for oxygen the three sets of experiment values are consistent with the present calculation. For the case of carbon, however, the intensity ratio can not be interpreted consistently on the assumption of the ionizing plasma model. Rather, it is strongly suggested that the plasma has a significant contribution from the recombining plasma component. Author

N84-15977# Los Alamos Scientific Lab., N. Mex.
A NEW NUMERICAL METHOD FOR THE TRANSIENT GAS-DYANMIC CODE EVENT
P. K. Tang [1983] 22 p refs
(Contract W-7405-eng-36)
(LA-9594-MS) Avail: NTIS HC A02/MF A01

A numerical method to solve a system of algebraic equations for severe gas dynamic transient problems is described. This technique involves the simultaneous consideration of both mass and energy balance at each nodal point, which should improve the convergence. A sample calculation is included. M.G.

N84-15978# Los Alamos Scientific Lab., N. Mex.
A MULTIPURPOSE PRODUCTION CONTROLLER FOR PLASMA PHYSICS CODES
Charles Snell [1983] 46 p
(Contract W-7405-eng-36)
(LA-9477-MS) Avail: NTIS HC A03/MF A01

The ACON program is a BCON controller designed to run large production codes on the CTSS Cray-1 or the LTSS 7600 computers. It can also be operated interactively, with input from the user's terminal. The controller can run one code or a sequence of up to ten codes during the same job. Options are available to get and save mass storage files, to perform historian file updating operations, to compile and load source files, and to send out print and film files. Special features include ability to retry after mass failures, backup options for saving files, startup messages for the various codes, and ability to reserve specified amounts of computer time after successive code runs. The ACON programs flexibility and power make it useful for running a number of different production codes. M.G.

N84-15979# Oak Ridge National Lab., Tenn.
EQUILIBRIUM STUDIES FOR LOW-ASPECT-RATIO TORSATRONS
L. Garcia, E. A. Carreras, J. H. Harris, H. R. Hicks, and V. R. Lynch Oct. 1983 40 p refs
(Contract W-7405-eng-26)
(DE84-002264; ORNL/TM-8833) Avail: NTIS

Three dimensional MHD equilibrium studies were done for low aspect ratio torsatrons. These studies cover continuous-coil and modular torsatrons. The equilibrium properties improve with aspect ratio, as is expected. The role played by the vertical field has also been investigated. Outward shifts cause the flux surfaces to deteriorate. Inward shifts improve the flux surfaces at the expense of stability properties. DOE

N84-15980*# National Aeronautics and Space Administration, Washington, D. C.
THERMAL AND ELECTRICAL INTERACTION OF TANTALUM WITH A LOW TEMPERATURE CHEMICALLY ACTIVE PLASMA FLOW
M. V. Zake, V. E. Liyepinya, and V. K. Melnikov Dec. 1983 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latviyskoy SSR, Ser. Fiz. i Tekhn. Nauk (USSR), no. 2, 1980 p 62-69 Original language document was announced as A80-37751 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77374; NAS 1.15:77374) Avail: NTIS HC A02/MF A01 CSCL 20I

The paper deals with an experimental study of radiative heat transfer and charge transfer processes from the surface of tantalum plates under conditions of unsteady high-temperature heating and oxidation. It is shown that at plate temperatures of 1800 K, the heat flux may be as high as 400 kW/sq m. Heating is shown to stimulate the emissivity of tantalum and the temperature of the free electrons which surface, through a gas boundary layer, from the plasma onto the metal. V.P.

N84-15981*# National Aeronautics and Space Administration, Washington, D. C.
COMPUTATIONS OF THE CURRENT PROFILE INFLUENCE ON TEARING INSTABILITY
P. M. Blekher, N. M. Zuyeva, and Z. I. Yurchenko Sep. 1983 24 p refs Transl. into ENGLISH of "Raschety vliyaniya profiliya toka na tiring-neustoychivost" Academy of Sciences USSR, Inst. of Applied Mathematics, imeni M. V. Keldysh, Preprint 149 Moscow, 1982 p 1-26 Transl. by Scitran, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-77285; NAS 1.15:77285; Preprint-149) Avail: NTIS HC A02/MF A01 CSCL 20I

Results of computations of tearing instability of a plasma column in a strong longitudinal magnetic field are presented for different current profiles. The power current profiles j=j sub 0(1-(r/a)(P))(nu) are considered and analyzed for various values of the parameters p and v. The tearing instability of the smoothed two-step profiles is studied. Optimal smoothed two-step profiles are constructed which are stable with respect to all helical largescale perturbations. M.G.

N84-15982# Indiana Univ., Bloomington. Dept. of Chemistry.
JET-IMPACT NEBULIZATION FOR SAMPLE INTRODUCTION IN INDUCTIVELY COUPLED PLASMA SPECTROMETRY Interim Technical Report
M. P. Doherty and G. M. Hieftje 23 Sep. 1983 39 p
(Contract N00014-76-C-0838)
(AD-A133152; INDU/DC/GMH/TR-83-57) Avail: NTIS HC A03/MF A01 CSCL 14/2

A novel, simple device for the production of liquid aerosol has been constructured and evaluated. In operation of this device, a sample solution is forced under pneumatic or mechanical pressure through an orifice of 25-60 micrometers in diameter. The resulting high-velocity stream of solution is directed onto a solid surface, thereby generating a fine aerosol. Details of nebulizer construction and operation are discussed and factors affecting nebulizer performance are examined. The utility of this nebulizer as a sample-introduction device for inductively coupled plasma spectrometry is explored. When coupled with an ICP, the jet-impact nebulizer compares favorably with a conventional pneumatic nebulizer in terms of precision, linearity, detection limits, and efficiency. Moreover, aerosol production is independent of any gas flow, making the device potentially useful in low-gas-flow plasmas. However, clogging of the nebulizer orifice with particulate matter can be a problem unless solutions are pre-filtered.
Author (GRA)

N84-15983# Old Dominion Univ., Norfolk, Va. Dept of Electrical Engineering.
AN INVESTIGATION OF ACCELERATING MECHANISMS IN A PLASMA FOCUS RELEVANT TO INTERRUPTING SWITCHES Final Report, 1 Nov. 1980 - 31 Jan. 1983
Mark S. Pronko and G. Marshall Molen Jul. 1983 113 p
(Grant AF-AFOSR-0039-81; AF Proj. 2301)
(AD-A133462; AFOSR-83-0794TR; FR-1) Avail: NTIS HC A06/MF A01 CSCL 20/9

An experimental investigation was conducted using a 34-kJ Dense Plasma Focus (DPF) in which the possible enhancement of the electron beam was addressed. Electron beams ejected from the DPF have been observed to exceed 30 kA with pulse durations of a few nanoseconds. Enhancement was considered to be either an increase in the probability that the peak beam current exceeded some lower limit, or an increase in the mean energy of the beam electrons. The investigation was divided into two parts, each addressing one of the aspects of enhancement.
GRA

N84-15984# Tennessee Univ., Knoxville.
PREIONIZATION AND START-UP IN THE ISX-B TOKAMAK USING ELECTRON CYCLOTRON HEATING AT 28 GHz
A. G. Kulchar, O. C. Eldridge, A. C. England, C. E. Bush, P. H. Edmonds, G. G. Kelley, C. M. Loring, Y.-K. M. Peng, J. B. Wilgen, and S. K. Borowski (Michigan Univ., Ann Arbor) Oct. 1983 31 p (Contract W-7405-eng-26)
(DE84-002261; ORNL/TM-8713) Avail: NTIS HC A03/MF A01

A 28-GHz gyrotron was used to produce a plasma at the electron cyclotron resonance in the impurity study experiment (ISX-B) Tokamak. The influence of the toroidal magnetic field magnitude, error fields, gas pressure, microwave power, microwave pulse length, and microwave timing was studied for experiments with magnetic field and gas only. Experiments with preionization followed by capacitor discharges were carried out in which these quantities were varied, as were the capacitor bank voltages. Optimum conditions of preionization for some of the parameters were determined. A theoretical model that adequately reproduces the data is given. The temporal evolution of the electron temperature and density, the neutral density, and the plasma current are shown with the model. DOE

N84-15985# Texas Univ., Austin. Inst. for Fusion Studies
ELIMINATION OF STOCHASTICITY IN STELLARATORS
J. D. Hanson and J. R. Cary Sep. 1983 14 p refs
(Contract DE-FG05-80ET-53088)
(DE84-001560; DOE/ET-53088/107) Avail: NTIS HC A02/MF A01

A method for optimizing stellarator vacuum magnetic fields is discussed. Application of this method shows that the stochasticity of vacuum magnetic fields can be made negligible by proper choice of the coil configuration. It is shown that the optimization increases the equilibrium (ALPHA)-limit by factors of two or more over that of the simple, straight coil winding law. The method is general and is applicable to other systems in which stochasticity: (1) is a problem; yet (2) is affected by the design parameters. DOE

N84-15986# Oak Ridge National Lab., Tenn.
RADIAL STRUCTURE OF CURVATURE-DRIVEN INSTABILITIES IN HOT-ELECTRON PLASMA
D. A. Spong, H. L. Berk, and J. W. VanDam Oct. 1983 41 p refs
(Contract W-7405-eng-26)
(DE84-002256; ORNL/TM-8883) Avail: NTIS HC A03/MF A01

Four different instability modes characteristic of hot electron plasmas were examined: the high-frequency hot electron interchange (at frequencies larger than the ion cyclotron frequency), the compressional Alfven instability, the interacting background pressure-driven interchange, and the conventional hot electron interchange (at frequencies below the ion cyclotron frequency). The decoupling condition between core and hot electron plasmas as it influences the background and hot electron interchange stability requirements was also studied. The assumed equilibrium plasma profiles and resulting radial mode structure differ somewhat from those used in previous local analytic estimates; however, when the analysis is calibrated to the appropriate effective radial wavelength of the nonlocal calculation, reasonable agreement is obtained. Comparison with recent experimental measurements indicates that certain of these modes may play a role in establishing operating boundaries for the ELMO Bumpy Torus-Scale (EBT-S) experiment. DOE

N84-15987# Texas Univ., Austin. Inst. for Fusion Studies.
NONLINEAR INTERACTION OF TOROIDICITY INDUCED DRIFT MODES
P. L. Similon and P. H. Diamond Sep. 1983 44 p refs
(Contract DE-FG05-80ET-53088)
(DE84-001562; DOE/ET-53088/105) Avail: NTIS HC A03/MF A01

Drift modes in toroidal geometry are destabilized by trapped electron inverse dissipation and evolve to a nonlinearly saturated state. Using renormalized one point turbulence theory for the nonlinear gyrokinetic equation in the ballooning representation, it is shown that ion Compton scattering is an effective saturation mechanism. Ion Compton scattering transfers wave energy from short to long perpendicular wavelength, where it is absorbed by ion resonance with extended, linearly stable, long wavelength modes. The fluctuation spectrum and fluctuation levels are calculated using the condition of nonlinear saturation. Transport coefficients and energy confinement time scalings are determined for several regimes. Specifically, the predicted confinement time density scaling for an ohmically heated discharge increases from n/sup 3/8/ in the collisionless regime to n/sup 9/8/ in the dissipative trapped electron regime. DOE

N84-15988# Texas Univ., Austin. Inst. for Fusion Studies.
DRIFT WAVES IN ROTATING PLASMAS
W. Horton and J. Liu Sep. 1983 39 p refs
(Contract DE-FG05-80ET-53088)
(DE84-000391; DOE/ET-53088/111; IFSR-111) Avail: NTIS HC A03/MF A01

The stability of the electron drift wave is investigated in the presence of E x B plasma rotation typical of the central cell plasma in tandem mirrors. A rotationally driven drift wave occurs at low azimuthal mode numbers. Conditions for rotational instabilities are derived. Quasilinear formulas are given for the anomalous transport associated with the unstable fluctuations. DOE

N84-15989# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
OBSERVATION OF MAGNETIC FIELDS IN LASER-PRODUCED PLASMA USING THE ZEEMAN EFFECT Interim Report
E. A. McLean, J. A. Stamper, C. K. Manka (Sam Houston State Univ.), H. R. Griem (Maryland Univ., College Park), D. W. Droemer (Sam Houston State Univ.), and B. H. Ripin 30 Sep. 1983 30 p refs
(Contract DE-AI08-79DP-40092)
(DE84-002742; NRL-MR-5161) Avail: NTIS HC A03/MF A01

The self-generated magnetic field produced when a pulsed Nd:glass laser is focused onto a carbon foil target is measured for the first time using the Zeeman effect. Emission from the CV 1s2s(3)S/sub 1(+)/ 1s2p(3)P2 (2270.9A) was used for the measurement. At a laser irradiance of approx. 5 x 10 to the 12th power W/cm(2), the magnetic field increased from 100 kG to 200 kG when the focal spot was changed from a flat-topped distribution to a ring pattern, which caused higher density gradients. A Faraday rotation measurement at approx. 200 kG agreed with the Zeeman effect measurement. Opacity effects in the plasma enhanced the sensitivity of the Zeeman measurement. DOE

N84-15990# Texas Univ., Austin. Inst. for Fusion Studies.
SUSTAINED SELF-REVERSAL IN THE REVERSED FIELD PINCH
A. Y. Aydemir and D. C. Barnes Aug. 1983 16 p refs
(Contract DE-FG05-80ET-53088)
(DE84-001559; DOE/ET-53088/102) Avail: NTIS HC A02/MF A01

Spontaneous reversal of the toroidal field in a Reversed Field Pinch as a result of low-beta kink-tearing mode activity is investigated using a 3D incompressible MHD code. Helical and 3D steady reversed states are obtained. In 3D a critical value of the pinch parameter is observed above which only quasi-steady fluctuating states are seen. DOE

N84-15991# Naval Research Lab., Washington, D. C.
VARIATION OF LASER ABSORPTION WITH PLASMA SCALE-LENGTH IN LONG-SCALELENGTH PLASMAS Interim Report
M. J. Herbst, J. Grun, J. Gardner, J. A. Stamper, and F. C. Young 30 Sep. 1983 12 p refs
(Contract DE-AI08-79DP-40092)
(DE84-002743; NRL-MR-5186) Avail: NTIS HC A02/MF A01

A short pulse, high intensity Nd laser beam which interacts with performed plasmas of variable scalelength was examined. It is found that the longest scalelength, absorption is limited by backscatter, despite increased collisional absorption. DOE

N84-16028*# Alabama Univ., Huntsville. Dept. of Industrial and Systems Engineering.
REFLECTANCE MEASUREMENTS, PART 2
Robert A. Brown *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 28 p (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20F

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N84-15992 Stevens Inst. of Tech., Hoboken, N. J.
AN NMR STUDY OF SOLID HYDROGEN USING PACKER SOLID ECHOES AND ROTATING REFERENCE FRAME RELAXATION Ph.D. Thesis
Robert A. Tharaldson 1982 155 p
Avail: Univ. Microfilms Order No. DA8323104

Jeener-Broekaert 90(x) - Tau 45(x) nuclear magnetic pulse sequences were applied to solid hydrogen for ortho concentrations less than 50%. (The notation 45(x) means a pulse of 45 degrees that is 90 degrees out of phase with the 90 degree pulse.) These measurements have been made at 4.2 K and to temperatures as low as 0.45 K. Below 1 K for the time tau longer than the free induction decay (FID) i.e., Tau T(z) multiple echoes were observed. These are the first quantitative verifications of the predicted relative echo amplitudes and decay constants in any material. Spin lattice relaxation measurements in the rotating reference frame at 4.2 K are presented. These are the first measurements in the rotating frame in the concentration range 10% to 50% ortho hydrogen. Dissert. Abstr.

N84-15993 Maryland Univ., College Park.
THE EFFECTS OF SPACE CHARGE ON IONIC MOBILITY MEASUREMENTS IN CYLINDRICAL GEOMETRIES Ph.D. Thesis
Robert Ernest Starrett 1982 200 p
Avail: Univ. Microfilms Order No. DA8323591

Ionic mobilities were measured using a cylindrical geometry conductivity cell with concentric electrodes. The spatially nonuniform field yields different time dependences for inward and outward moving charge species. Using a bremsstrahlung converter as a target, uniform doses of radiation were provided with a 10 MeV beam from a linear accelerator. Time dependent currents were measured for solutions of 0.35M methyl iodide in iso-octane. A theoretical model was developed to analyze the observed current time curves. The model explicitly includes space charge perturbations to the 1/r dependence of the electric field. Motion of the charges under this field is solved with the inclusion of additional terms to handle bi-molecular recombination and diffusion. The model also treats the case where more than one cation species are produced. The model gives current time curves which are in good agreement with experimental results. The effects of space charge with variations in field strength and dose are clearly demonstrated, both in the field and in the resulting current time curves. Evidence from the experimental curves suggests that multiple positive charge carriers are present. Dissert. Abstr.

N84-15994# Radiation Monitoring Devices, Inc., Watertown, Mass.
REPLICATED CdTe SUBSTRATES Final Report, May 1982 - May 1983
J. Lund, M. Squillante, and G. Entine Wright-Patterson AFB, Ohio AFWAL Sep. 1983 22 p
(Contract F33615-82-C-5076; AF Proj. 2423)
(AD-A133114; AFWAL-TR-83-4067) Avail: NTIS HC A02/MF A01 CSCL 20/12

There is now a critical need for large numbers of high quality single crystal CdTe substrates for LPE growth of HgCdTe to use in infrared focal plane array sensors. The CLEFT crystal growth process, originally used to grow thin GaAs single crystals of solar cell applications, potentially offers a practical solution to this problem. Therefore, to investigate this unique crystal growth process further, a proof of concept research program was carried out to determine if this attractive technique could be applied to CdTe. The result of this research has been the growth of 1 sq cm continuous CLEFT layer of CdTe over an appropriate CLEFT growth mask. This is proof that the needed lateral growth does occur for CdTe oriented in the (III) direction. The procedures used to achieve this are discussed in detail in this report. GRA

N84-15995# Rockwell International Corp., Thousand Oaks, Calif. Microelectronics Research and Development Center.
AlGaAsSb VAPOR PHASE EPITAXY AND LASER PROGRAM Final Technical Report, Oct. 1980 - Oct. 1982
Raymond Chin Griffiss AFB, N.Y. RADC Jun. 1983 99 p
(Contract F19628-80-C-0130; AF Proj. 4600)
(AD-A133123; MRDC41078.9FR; RADC-TR-83-127) Avail: NTIS HC A05/MF A01 CSCL 20/12

As the transmission of glass optical fibers has been reduced to near the theoretical limits in the 1.2-1.6 micrometers wavelengths range, the interest in optical emitters and detectors operating in this spectral range has increased. Currently, state-of-the-art silica-based optical fibers have been produced with minimum loss of 0.2 dB/km at a wavelength of lambda = 1.55 micrometers. The dispersion at this wavelength is also extremely low (approx. 17 sp/nm-km). Emitters and detectors for this spectral region have been fabricated in two of the III-V quaternary materials systems; i.e., AlGaAsSb and InGaAsP. The emphasis of this program was to develop the metalorganic chemical vapor deposition (MOCVD) materials technology for the growth of AlGaAsSb-GaSb and AlGaAsSb-InAs for heterostructure devices. Described in this work is the successful demonstration of the hetero-epitaxy of lattice-matched GaAsSb-InAs, GaSb/InAs, GaAlSb/GaSb with AlSb mole fractions up to 0.37, and n- and p-type GaSb/GaSb structure by MOCVD. In addition, Schottky barrier photodiodes fabricated from material grown by MOCVD clearly show that high quality crystalline material can be obtained using this process. GRA

N84-15996# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
CONTROL OF IMPURITIES IN THE EPITAXIAL GROWTH OF HIGH QUALITY GaAs Final Report
David A. Stevenson Sep. 1983 17 p
(Contract N00014-75-C-0887)
(AD-A133187) Avail: NTIS HC A02/MF A01 CSCL 20/12

A research program is described on the topic of impurity incorporation during the growth of GaAs epitaxial layers. The major portion of the research was the design, construction, and characterization of a molecular beam mass spectrometry (MBMS) system and its use as a diagnostic analytical tool to evaluate typical gaseous environments used in the growth of III-V single crystal layers. The fundamental gas dynamics of the MBMS sampling process were studied as well as the limitations and correction factors for this technique. Two crystal growth environments were analyzed: a liquid phase epitaxial (LPE) GaAs growth system; and an organometallic vapor phase epitaxy (OMVPE) system. In the former system, it was shown that there are significant concentrations of O, C, Si gaseous species in the gas ambient which appear to be the major potential impurities. For OMVPE, two topics were emphasized: the side reactions of the organometallic (OM) reactants, particularly those involving oxygen containing species; and the graphite-OM interaction. GRA

N84-15997*# Stanford Univ., Calif. Dept of Materials Science and Engineering.
FABRICATION AND PROPERTIES OF MULTILAYER STRUCTURES Final Technical Report, 1 Sep. 1981 - 30 Sep. 1982
William A. Tiller Sep. 1983 50 p Sponsored by NASA Prepared in cooperation with Stanford Joint Institute for Surface and Microstructure Research.
(Contract MDA903-81-C-0578; Grant ARPA Order 3706)
(NASA-CR-174506; NAS 1.26:174506; AD-A133402;

SU-DMS-83-R-5) Avail: NTIS HC A03/MF A01 CSCL 20L

The synthesis of SiC films and Pd2Si films via single source and dual source sputtering, respectively, has been experimentally investigated while the reactive sputter deposition of SiO sub x films has been theoretically analyzed. The SiO sub x film data requires a mobile precursor adsorption process to be operative for the oxygen and an oxygen sticking coefficient of between 1.56 x 10 to the minus 3rd power and 4.17 x 10 to the minus 3rd power. An analysis of in-situ electrical diagnostics of the films via a non-contact technique shows the method to be of marginal accuracy for the example selected. An important new formulation of the stress and elastic constant tensors in the vicinity of interfaces has been developed and applied to the simple example of adsorbed layer/substrate interactions via a parametric analysis. Atomic modeling of the SiO system yields peroxide bond formation for oxygen-rich (100) alpha-cristobalite surfaces. Radial distribution function and angular distribution function data have been calculated for bulk alpha-quartz and bulk alpha-cristobalite in good agreement with experiment. Author (GRA)

N84-15998# Motorola, Inc., Carlisle, Pa. Quartz Operations.
MANUFACTURING TECHNOLOGY FOR HIGH QUALITY SWEPT-CULTURE GROWTH QUARTZ Interim Report, 13 Apr. 1982 - 13 Apr. 1983
Joseph F. Balascio and Nicholas C. Lias Griffiss AFB, N.Y. RADC Sep. 1983 63 p
(Contract F19628-82-C-0067; AF Proj. 3020)
(AD-A133500; RADC-TR-83-209) Avail: NTIS HC A04/MF A01 CSCL 20/2

Relatively low impurity alpha-quartz has been grown from the hydroxide mineralizer system with the use of three types of nutrient: converted, special cultured and cultured. The converted nutrient resulted in the lowest total ppm level (2.6) and Al ppm level (0.5) in the as-grown crystals. Special cultured and cultured nutrients resulted in 1.7 ppm and 2.1 ppm of aluminum in crystals grown, respectively, from these nutrients. Infrared Q values ranged from 2.5x10 to the 6th power in these crystals. With respect to rho in the as-grown crystals, a ten minute etching of seeds in 7.0 molal ammonium bifluoride has resulted in the growth of the lowest etch channel density crystals (approx = 135/sq cm). GRA

N84-15999# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
DETERMINATION OF IONIZATION RATES IN THE PRINCIPAL CRYSTALLOGRAPHIC DIRECTIONS IN SILICON Final Technical Report, 1 May 1979 - 30 Apr. 1981
Charles A. Lee Griffiss AFB, N.Y. RADC Aug. 1983 36 p
(Contract F19628-79-C-0105; AF Proj. 2306)
(AD-A133513; RADC-TR-83-182) Avail: NTIS HC A03/MF A01 CSCL 20/12

Measurements of the electron and hole multiplication in silicon p-n junctions and the associated electron and hole ionization rates are presented for the three principal directions <100>, <110>, and <111>. It is shown that published ionization threshold energies are inconsistent with the experimental data. The inconsistency is traced to the fact that the appropriate non-colinear wave vector constructions for conserving crystal momentum in the ionizing collision process were not considered in the previous threshold calculations. An approximate solution to collisions with non-colinear wave vectors is presented that shows qualitative agreement with the experimental observations. Author (GRA)

N84-16000# Hughes Research Labs., Malibu, Calif.
STUDY OF PHASE DIAGRAMS OF TERNARY SEMICONDUCTORS Final Report, 20 Apr. 1980 - 19 Jul. 1983
R. Kikuchi Aug. 1983 91 p
(Contract DAAG29-80-C-0116)
(AD-A133556; ARO-17090.3-PH) Avail: NTIS HC A05/MF A01 CSCL 20/12

In this three-year project on the theoretical studies of Hg-Cd-Te phase diagram, the liquidus and solidus have been calculated using the conditions to thermal coexistence of the liquid and solid. The pair approximation of the cluster variation method is used throughout, and the energy parameters are always treated as independent of temperature and composition. The lattice defects in the solid are neglected in the first treatment. By choosing energy parameters, it is possible to make the theroretical liquidus and solidus agree reasonably well with experiments. In the later formulation, lattice vacancies and antiatoms are taken into account. Then the theory shows that the temperature dependence of Hg vacancies is the same as that of holes in the valence band. The relation between the hole concentration and the partial pressure of Hg can also be derived with good agreement with experience. GRA

N84-16001# Varian Associates, Palo Alto, Calif.
ORGANOMETALLIC EPITAXY FOR GaAs/AlGaAs MICROWAVE TRANSISTORS AND INTEGRATED CIRCUITS Final Report, 15 Jun. 1980 - 14 Jun. 1983
S. Bandy and V. Aebi Sep. 1983 5 p
(Contract DAAG29-80-C-0114; DA Proj. 1L1-61102-BH-57)
(AD-A133560; ARO-16487.1-EL) Avail: NTIS HC A02/MF A01 CSCL 20/12

Applications of atmospheric-pressure organometallic-grown GaAs-AlGaAs epitaxial (OMVPE) structures to potentially improved or new microwave FET structures were investigated. These included AlGaAs buffer layers for low-noise FETs, AlAs buffer layers for power FETs, and use of the selective etching of AlGaAs buffer layers to produce air-isolated FETs. The presence of increased trapping densities in the buffer layers, or surface states on the exposed channel layer in the case of the air-isolated structure, degraded rather than enhanced FET performance. Excellent performance was, however, obtained with conventional GaAs low-noise FETs grown entirely by OMVPE. HEMT structures were also grown by OMVPE, but did not show the increased mobilities of identical structures grown by MBE. GaAs/AlGaAs structures analogous to silicon MOSFETs were also fabricated. Inversion of p-type substrates (n-channel operation) could not be obtained but, unexpectedly, indications were obtained if successful inversion of n-type material (p-channel operation). GRA

N84-16002# Geo-Centers, Inc., Newton, Mass.
EVALUATION OF RADIATION DAMAGE TO METAL-OXIDE-SEMICONDUCTOR (MOS) DEVICES
Dec. 1982 10 p
(Contract N00014-82-C-2361)
(AD-A133593; GC-TR-82-260) Avail: NTIS HC A02/MF A01 CSCL 20/12

The purpose of these experiments was to provide qualitative and quantitative information on the effects of various hydrogen and nitrogen annealing treatments on the radiation hardness, or resistivity to damage, of MOS capacitors. Toward this end, the following tasks were performed: Construction of capacitor TO-5 packages for device evaluation; The experimental determination of the 1 MHz capacitance-voltage bias curves for both the pre- and post-irradiated capacitors; Evaluation of the change in Flat Band Voltage (Delta V sub fb) for the pre- and post-radiation stressed devices; Compilation of all 1 MHz data for cataloging purposes and the establishment of a benchmark for the new computer automated test system; and Reported data to the Contracting Officer's Technical Representative (COTR) on a case-by-case basis, as time was of the essence. GRA

N84-16003# Los Alamos Scientific Lab., N. Mex.
SUPERCONDUCTING GROUND STATE OF A STRONGLY INTERACTING ELECTRON SYSTEM: UBe13
H. R. Ott, H. Rudigier, Z. Fisk, and J. L. Smith 1983 8 p refs Presented at the NATO/CAP Inst. on Moment Formation in Solids, Vancouver Island, Canada, 21 Aug. - 2 Sep. 1983 Prepared in cooperation with Eidgenoessische Technische Hochschule, Zurich, Switzerland
(Contract W-7405-eng-36)
(DE84-001708; LA-UR-83-2982; CONF-8308132-1) Avail: NTIS HC A02/MF A01

The following experimental properties of UBe13 are discussed: magnetic susceptibility, magnetization, electrical resistivity, and

specific heat. Results suggest that the superconducting state of UBe13 may not be primarily due to conventional electron-phonon coupling, but rather a result of interactions of magnetic origin, probably antiferromagnetic. DOE

N84-16004# Sandia Labs., Albuquerque, N. Mex.
InAsSb STRAINED-LAYER SUPERLATTICES FOR LONG WAVELENGTH DETECTOR APPLICATIONS
G. C. Osborn 1983 13 p refs Presented at the 5th Molecular Beam Epitaxy Workshop, Atlanta, 6 Oct. 1983
(Contract DE-AC04-76DP-00789)
(DE84-001055; SAND-83-2148C; CONF-8310188-1) Avail: NTIS HC A02/MF A01

InAsSb strained layer superlattices were proposed as III to V candidates for 8 to 12 (SIGMA)m applications. The wavelength response of certain InAsSb SLSs is extended beyond 12 (SIGMA)m at 770K through the intentional use of layer strains, regardless of the conduction band offsets in this system. This material system offers the metallurgical and device processing advantages of III to V semiconductors. The InAsSb SLSs also offer reduced sensitivity to lateral compositional variation and reduced band to band tunneling compared to bulk HgO 7(??)5Ca0 205Te. DOE

N84-16005# Oak Ridge National Lab., Tenn. Solid State Div.
RAMAN MEASUREMENTS OF THE MOBILE CATION VIBRATIONS IN Na, K, Ag AND Li (ALPHA)'-ALUMINA
N. J. Dudney, J. B. Bates, and W. E. Brundage May 1983 9 p refs Presented at the 4th Intern. Conf. on Solid State Ionics, Grenoble, France, 4 Jul. 1983 Submitted for publication
(Contract W-7405-eng-26)
(DE83-015697; CONF-830708-6) Avail: NTIS HC A02/MF A01

Single crystals of Na, K, Ag and Li (ALPHA)"-alumina were measured by Polarized Raman measurements. For each material, the modes due principally to the mobile cations are identified. The number and symmetry of the observed modes is explained by considering the local ordering of the cations as a two dimensional superlattice. Raman spectra for a number of Na (ALPHA)"-alumina samples with different growth temperatures, compositions, and degrees of hydration were compared. Several of the observed differences in the Raman intensities are attributed to the effects of either composition or short range superlattice ordering. A Raman mode which is a likely candidate for the attempt mode for diffusion is identified for the Na, K and Ag crystals. DOE

N84-16006# Sandia Labs., Albuquerque, N. Mex.
AN In0 2Ga0 8As/GaAs, MODULATION-DOPED, STRAINED-LAYER SUPERLATTICE FIELD-EFFECT TRANSISTOR
T. E. Zipperian, L. R. Dawson, G. C. Osbourn, and I. J. Fritz 1983 5 p refs Presented at the Intern. Electron Device Meeting, Washington, D.C., 5 Dec. 1983
(Contract DE-AC04-76DP-00789)
(DE84-000136; SAND-83-1657C; CONF-831243-1) Avail: NTIS HC A02/MF A01

Field-effect transistor action was demonstrated in InGaAs/GaAs strained-layer superlattice (SLS) material. The samples, prepared by MBE, utilized 17 periods (repeat distance, 300A) of alternating, modulation-doped, In(0.2)Ga(0.8)As and GaAs layers to form the channel of the device. Gate control was realized by use of an Al Schottky diode on the top and a p-n junction diode, formed between the superlattice and a p-type In(0.1)Ga(0.9)As buffer layer, on the bottom. At room temperature a representative transistor with a 2.5 micron gate length displayed a characteristic drain saturation current, I sub DSS, of 64 mA (V sub DS = 4V, V sub GS = OV), a double-gate pinchoff voltage, Vp, of 3.1V(V sub DS = 4V, I sub D = 5% of I sub DSS) and a maximum, double-gate, normalized, extrinsic transconductance, q sub mo, of 84mS/mm (v sub DS = 4V). At 77K, I sub Dss increased to 98mA, Vp remained approximately constant at 3.2V, and q sub mo increased to 140mS/mm. DOE

N84-16007# Los Alamos Scientific Lab., N. Mex.
STRUCTURAL STUDIES AT ELEVATED PRESSURE AND REDUCED TEMPERATURES USING SYNCHROTRON RADIATION: APPLICATION TO Ce.8La.1Th.1
E. F. Skelton, A. W. Webb, W. T. Elam, S. A. Wolf, S. B. Qadri (Sachs-Freeman Associates, Inc.), C. Y. Huang (Los Alamos National Labs.), P. M. Chaikin (California Univ., Los Angeles), R. C. Lacoe (California Univ., Los Angeles), and K. A. Gschneidner (Iowa State Univ., Ames) 1983 6 p refs Presented at the 9th AIRAPT Intern. Conf. on High Pressure Sci. and Technol., Pittsburgh, 8 Nov. 1983
(Contract W-7405-eng-36)
(DE84-001793; LA-UR-83-2928; CONF-831194-1) Avail: NTIS HC A02/MF A01

The rapid acquisition of structural information from a sample pressurized in a diamond-anvil cell and cooled to cryogenic temperatures is described. The system employs a closed-cycle He-refrigerator which is continuously operated, independent of any liquid cryogens, from a remote control station; the sample temperature is maintained constant to better than 0.05 K. The compressive contact force between the diamond anvils, and hence the sample pressure, is also externally controlled, thereby providing remote control capabilities for both the pressure and the temperature. Preliminary data on the critical points and colume changes associated with the pressure/temperature induced isomorphic phase transition in Ce8La1Th1 are presented. DOE

N84-16008# Sandia Labs., Albuquerque, N. Mex.
ION-BEAM ANALYSIS AND ION IMPLANTATION IN THE STUDY OF DIFFUSION
S. M. Myers 1983 18 p refs Presented at the Diffusion Symp., Philadelphia, 2 Oct. 1983
(Contract DE-AC04-76DP-00789)
(DE84-000354; SAND-83-0591C; CONF-8310169-1) Avail: NTIS HC A02/MF A01

High-energy ion-beam analysis has several desirable features for depth profiling of diffusion couples. The technique is nondestructive, it offers depth resolutions in the range 0.01 to 1 micron, and absolute measurements of both concentration and depth are achieved without the use of reference standards. Ion implantation provides a means for the initial formation of diffusion couples; through the athermal injection of solutes directly into hosts, this approach circumvents several difficulties associated with surface deposition. The application of ion beams to diffusion measurements are first discussed in general terms and then illustrated by two examples. In one case study the diffusion of ion-implanted Sn in Fe was observed by elastic backscattering analysis, thereby extending the range of measured diffusivities downward by 10(5) times. In the other investigation, nuclear reaction analysis was used to depth profile the decay product (3)He in stainless steels exposed to tritium; this permitted a determination of the tritium diffusivity at 273 K, where the migration rate is 10(3) times smaller than that detected previously through gas permeation methods. DOE

N84-16009# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
SPECIFIC HEAT OF He-3 IN THE FERMI LIQUID REGION
M. C. Mayberry and Norman E. Phillips Mar. 1983 20 p refs Presented at the Quantum Fluids and Solids Conf., Sanibel Island, Fla., 13 Apr. 1983
(Contract DE-AC03-76SF-00098)
(DE83-011566; LBL-15646; CONF-830456-3) Avail: NTIS HC A02/MF A01

A CMN thermometer has been calibrated by nuclear orientation thermometry at low temperatures and He vapor pressure thermometry at high temperatures. The calibration agrees well with the NBS temperature scale between 100 and 200 mK. Specific heat data on He-3 in the Fermi-liquid region obtained with this thermometer are in good agreement with recent measurements at Bell Laboratories. It is argued that discrepancies with other data can be understood on the basis of errors in the temperature scales on which they are based. DOE

N84-16010# Ames Lab., Iowa.
MOESSBAUER SPECTROSCOPY STUDY OF AMORPHOUS

Fe87B11Au2 RIBBON AND ITS CRYSTALLIZATION PRODUCTS
M. C. Lin and R. G. Barnes 1983 14 p refs Presented at the MMM Conf., Pittsburgh, 8-11 Nov. 1983
(Contract W-7405-eng-82)
(DE83-018091; IS-M-459; CONF-831187-1) Avail: NTIS HC A02/MF A01

Substantial increases in Fe saturation magnetization were obtained in amorphous Fe-B containing small concentrations of gold. This material is also stable above 300 K, and thus has considerable practical significance. The results of an investigation of amorphous Fe87B11Au2 ribbon and its crystallization products based on (57)Fe Moessbauer spectroscopy are given. The amorphous ribbon exhibits a broad magnetic hyperfine splitting pattern typical of a metallic glass with an effective hyperfine field, H sub eff = 257 kOe, and an isomer shift of 0.058 mm/s relative to metallic Fe at 300 K. The spectra of samples annealed for 25 min between T sub A = 618 K and 708 K arise from a metastable amorphous phase of Fe-Au-B and a crystalline (-)-Fe phase. H sub eff of the metastable amorphous phase decreases with respect to increased annealing temperature. However, H sub eff of the (-)-Fe phase increases from 331 kOe for samples annealed at 618 K to 334 kOe for those annealed at 708 K. This increase can be attributed to an increased content of Au in the (-)-Fe phase. Annealing the samples at temperatures above 753 K for 25 min yields crystalline (-)-Fe and the intermetallic compound Fe2B. DOE

N84-16011# Electrotechnical Lab., Ibaraki (Japan).
SUPERCONDUCTING PROPERTIES OF Nb3Sn MULTIFILAMENTARY WIRES FABRICATED BY INTERNAL TIN PROCESS
N. Higuchi, K. Tsuchiya, C. J. Klamut, and M. Suenaga 1983 8 p refs Presented at the Cryogenic Eng. Conf. and Intern. Cryogenic Mater. Conf., Colorado Springs, 15 Aug. 1983
(Contract DE-AC02-76CH-00016)
(DE83-018189; BNL-33600; CONF-830841-24) Avail: NTIS HC A02/MF A01

Heat treatments were divided into prereaction and reaction treatments. The main microstructural difference in the two heat treatments are in the amounts of the large Kirkendal's voids. The grain size increased at the higher temperatures. The superconducting critical temperature and current density were measured. It is assumed that a current density of greater than or equal to 1200 A/mm(2) can be achieved if the filament size and heat treatment can be optimized. DOE

N84-16012# Naval Research Lab., Washington, D. C.
ROLE OF PRESSURE IN UNDERSTANDING THE ANOMALOUS SUPERCONDUCTIVITY IN EUROPIUM (MOLYBDENUM)6 (SULFUR)8 AND (TMTSF)2FSO3
S. A. Wolf, C. Y. Huang (Los Alamos Lab.), R. C. Lacoe (California Univ., Los Angeles), P. M. Chaikin (California Univ., Los Angeles), W. W. Fuller, H. L. Luo (California Univ., San Diego), and F. Wudl (Bell Labs., Murray Hill, N.J.) 1983 11 p refs Presented at the 9th AIRAPT Conf., Albany, 25-28 Jul. 1983
(Contract W-7405-eng-36)
(DE83-017292; LA-UR-83-2451; CONF-830763-13) Avail: NTIS HC A02/MF A01

Both the Chevrel phase compound EuMo6S8 and the organic material, (TMTSF)2FSO3 are superconducting only under moderate pressure. In both instances the absence of superconductivity at ambient pressure is directly attributed to a low temperature structural distortion that introduces a gap over all or part of the Fermi surface. The role of pressure is to suppress the transition and thus allow the electrons to condense into the superconducting state. In EuMo6S8, details of the pressure dependence of both the structural and superconducting transition were explained on the basis of a competition between a charge density wave type state and superconductivity. In the case of (TMTSF)2FSO3 an anion ordering giving rise to a metal insulator transition is responsible for suppressing superconductivity. The critical magnetic fields of EuMo6S8 are extremely anomaloue and are related to the magnetism of the Eu as well as the structure of the compound. DOE

N84-16013# Argonne National Lab., Ill.
HIGH-RESOLUTION SOLID-STATE (13)C NMR STUDY OF THE TEMPLATING CATIONS IN TETRAPROPYLAMMONIUM FLUORIDE SILICALITE: THE EFFECT OF STERIC INTERACTIONS
L. E. Iton, H. A. Resing (NRL), and R. L. Patton (Union Carbide Corp., Tarrytown, N.Y.) 1983 4 p refs Presented at the 6th Intern. Zeolite Conf., Reno, Nev., 10 Jul. 1983
(Contract W-31-109-eng-38)
(DE83-011706; CONF-830756-1) Avail: NTIS HC A02/MF A01

The high resolution solid state (13)C NMR spectrum of the TPA fluoride silicalite was examined at 50.3 MHz, using proton cross polarization (CP), magic angle spinning (MAS), and heteronuclear dipolar decoupling techniques. The methyl group (13)C resonance is split into a doublet with chemical shift difference of approx. = 1.1 ppM. It is suggested that the splitting in ZSM-5 zeolite is due to slightly different chemical environments for the methyl groups in the two sets of channels, and it is inferenced that the CPMAS (13)C NMR spectrum is sensitive to weak interactions between organic molecules and the zeolite framework. The results of the crystal structure determination yield a value of the end C(??)-C(??) separation in this channel of 2.72 A, compared to a separation C3-C6 of 3.09 A for the end carbons in the undulating channel. The NMR results confirm that the distances are significantly different. DOE

N84-16014# Los Alamos Scientific Lab., N. Mex.
ELECTRON-ELECTRON INTERACTIONS AND BROKEN SYMMETRY IN ONE DIMENSION
S. Mazumdar and S. N. Dixit (Exxon Research and Engineering Co., Linden, N.J.) 1983 16 p refs Presented at Workshop on Synthetic Metals, Los Alamos, N. M., 20 Aug. 1983 Submitted for publication
(Contract W-7405-eng-36)
(DE84-001704; LA-UR-83-3014; CONF-8308133-1) Avail: NTIS HC A02/MF A01

A novel real space approach to dimerization in a half filled band is developed to investigate effects of electron-electron interactions of the Peierls instability. Dimerization is shown to be a result of imperfect resonance between pairs of electron configurations related to each other by a mirror plane symmetry passing through the longest diagonal of the infinite polygon. Coulomb interactions enhance the barrier to perfect resonance, so that dimerization itself is enhanced for moderate values of the correlation parameter. Recent experimental findings and the present theoretical work then suggest that explicit inclusion of Coulomb interactions between electrons is necessary for an accurate description of ground and excited states in polyacetylene. DOE

N84-15300# Natal Univ., Pietermaritzburg (South Africa). Dept. of Physics.
ETCHING OF DEFECTS ON CRYSTAL SURFACES
P. J. Jackson *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 13-19 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15301# Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik.
SURFACE ANALYSIS BY PARTICLE BEAMS
F. Viehboeck, P. Braun, and F. Ruedenauer *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 23-29 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15302# Witwatersrand Univ., Johannesburg (South Africa). Nuclear Physics Research Unit.
SURFACE AND NEAR-SURFACE ANALYSIS OF DIAMOND BY RBS

T. E. Derry and J. P. F. Sellschop *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 31-37 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15306# Muenster Univ. (West Germany). Inst. fuer Physikalisches.
SECONDARY ION EMISSION FROM ADSORBATE LAYERS ON POLYCRYSTALLINE Ni
M. Schemmer, P. Beckmann, D. Griefendorf, and A. Benninghoven *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 63-71 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15307# Zimbabwe Univ., Salisbury. Dept. of Mechanical Engineering.
THE USE OF AUGER ELECTRON SPECTROSCOPY AND ELLIPSOMETRY IN THE STUDY OF CORROSION INHIBITION
Gladius Lewis *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 75-81 refs (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15326# Pretoria Univ. (South Africa). Fisikadepartement.
STRUCTURAL PROPERTIES OF EPITAXIAL SINGLE LAYER METALS ON (110) B.C.C. METAL SUBSTRATES [STRUKTUUR VAN EITAKSIALE MONOLAE VAN METALE OP (110) B.C.C. METAALSUBSTRATE]
Jan H. vanderMerwe *In* Natl. Phys. Res. Lab. Proc. of Symp. on Surface Sci. and its Ind. Implications 1981 p 249-256 refs In AFRIKAANS; ENGLISH summary (For primary document see N84-15298 06-31)
Avail: NTIS HC A10/MF A01

N84-15925# California Univ., Berkeley. Lawrence Berkeley Lab.
LARGE AREA NON-CRYSTALLINE SEMICONDUCTOR DETECTORS
V. Perez-Mendez, T. Mulera, S. N. Kaplan, and P. Wiedenbeck *In* LBL Proc. of the 1983 DPF Workshop on Collider Detectors: Apr. 1983 p 99-100 refs (For primary document see N84-15911 06-72)
Avail: NTIS HC A09/MF A01

N84-16055*# Alabama A & M Univ., Huntsville. Dept. of Physics.
COMPOSITIONAL SEGREGATION IN UNIDIRECTIONALLY SOLIDIFIED SOLID SOLUTION CRYSTALS
Jai-Ching Wang *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 32 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20B

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N84-16015 Argonne National Lab., Ill.
FUTURE SEARCH FOR GRAND UNIFIED THEORY MAGNETIC MONOPOLES
D. Ayres, D. Cline (Wisconsin Univ.), K. Heller (Minnesota Univ.), W. Marciano (BNL), and R. Shrock (State Univ. of New York, Stony Brook) 1983 19 p refs Presented at the DPF Summer Study on Elementary Particle Phys. and Future Facilities (APS), Aspen, Colo., 28 Jun. 1982
(Contract W-31-109-eng-38)
(DE83-009451; ANL-HEP-CP-82-64; CONF-8206116-25) Avail: NTIS HC A02

The present experimental limits and experimental techniques in the search for very massive magnetic monopoles were discussed. An attempt to survey possible future experiments and the limits of the experimental techniques with emphasis on the type of R and D that will be useful in these searches is made. DOE

N84-16016# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[PROJECT OBJECTIVES AND PROGRESS AT THE RESEARCH LABORATORY OF ELECTRONICS] Progress Report
J. Allen Jan. 1983 209 p refs
(RLE-125) Avail: NTIS HC A10/MF A01

Molecule microscopy, semiconductor surface studies, atomic resonance and scattering, reaction dynamics at semiconductor surfaces, X-ray diffuse scattering, phase transitions in chemisorbed systems, optics and quantum electronics, photonics, optical spectroscopy of disordered materials and X-ray scattering from surfaces, infrared nonlinear optics, quantum optics and electronics, microwave and millimeter wave techniques, microwave and quantum magnetics, radio astronomy, electromagnetic wave theory and remote sensing, electronic properties of amorphous silicon dioxide, photon correlation spectroscopy and applications, submicron structures fabrication, plasma dynamics, optical propagation and communication, digital signal processing, speech communication, linguistics, cognitive information processing, custom integrated circuits, communications biophysics, and physiology, are discussed. N.W.

N84-16017# United Technologies Research Center, East Hartford, Conn.
HEAT TRANSFER RETARDATION AT ELEVATED TEMPERATURES. PHASE 1: ANALYSIS OF HEAT TRANSFER RETARDATION CONFIGURATIONS AND MATERIALS Annual Technical Report, 15 Aug. 1982 - 14 Aug. 1983
Charles W. Deane Sep. 1983 110 p
(Contract N00014-82-C-0671; NR Proj. 097-457; RR0240302)
(AD-A133509; UTRC/R83-956216-1) Avail: NTIS HC A06/MF A01 CSCL 20/13

The heat transfer retardation characteristics at high temperatures of selected combinations of configurations and their materials of construction were analyzed, and lightweight retardation configurations have been identified for hot-gas applications with hot-side temperatures of 3000 F. The scope of the investigation was to use available materials and passive retardation techniques. Candidate structural configurations with promising heat transfer retardation characteristics were defined, candidate materials were identified, and combinations of these configuration types and their materials of construction were selected for analysis. A heat transfer model was formulated for the analyses of the retardation configurations selected for hot-gas applications and was used to estimate the retardation characteristics in terms of an overall thermal resistance and unit weight. Multi-layer configurations were selected with the thin outer layer of ceramic foam providing a hard and relatively smooth surface for flow path and structure, and the inner fibrous layer(s) providing the bulk of the thermal resistance. The overall lightweight combination consists of All-Alumina foam and dynaquartz (silica) fibrous insulation, because each material has the lowest value of the insulation performance factor in its category of materials. Author (GRA)

N84-16018# Stanford Linear Accelerator Center, Calif.
PROBLEMS AT THE INTERFACE BETWEEN PERTURBATIVE AND NONPERTURBATIVE QUANTUM CHROMODYNAMICS
Stanley J. Brodsky, G. T. Bodwin (Argonne National Lab.), and G. Peter Lepage (Cornell Univ.) Jun. 1983 27 p refs Presented at the Workshop on Non-Perturbative QCD, Stillwater, Okla., 6-9 Mar. 1983
(Contract DE-AC03-76SF-00515)
(DE84-002375; SU-SLAC-PUB-3136; CONF-830368-3) Avail: NTIS HC A03/MF A01

A procedure to rectify perturbative expansion for hard scattering amplitudes is discussed. Exclusive processes, the factorization of hadronic amplitudes at large momentum transfer in the form of

distribution amplitudes convoluted with hard scattering quark-gluon subprocess amplitudes is demonstrated systematically to all orders in (-)-sub s/(Q(2)). In inclusive reactions, factorization remains an ansatz; general all orders proofs do not exist because of the complications of soft initial state interactions for hadron induced processes; factorization was only verified to two loops beyond lowest order in a regime where the applicability of perturbation theory is in doubt. A necessary condition for the validity of factorization in inclusive reactions indicates that the momentum transfer must be large compared to the length of the target. The present status of the factorization ansatz is reviewed. DOE

N84-16019# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
THERMODYNAMICS OF AQUEOUS SODIUM CHLORIDE TO 823 K AND 1 KBAR
Kenneth S. Pitzer and Yi-gui Li (Tsinghua Univ.) Aug. 1983 27 p refs Presented at the Intern. Solvent Extraction Conf., Denver, 26 Aug. - 2 Sep. 1983
(Contract DE-AC03-76SF-00098)
(DE84-001841; LBL-16561; CONF-830808-13) Avail: NTIS HC A03/MF A01

It is shown that a very simple semi-empirical equation represents accurately the thermodynamic properties of aqueous sodium chloride from 373 K to 823 K. The equation comprises one Margules term and a Debye-Hueckel term. Just the one Margules parameter is freely adjustable since the Debye-Hueckel parameter is determined by the properties of water. The equation is valid from the saturation composition down to infinite dilution for solvent density above 0.75 g cm(+3) but at lower density only above a solute mole fraction of about 0.1 on an ionized basis. Both solute and solvent activity coefficients are fitted from the lowest pressure of solution existence up to 1 kbar. Derivation of enthalpy and other related functions is discussed. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N84-16020*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLEVELAND SPACE ODYSSEY
23 Mar. 1980 136 p refs Symp. held at Cleveland, 16-23 Mar. 1980 Sponsored in part by Cuyahoga Community College and Cleveland Public Schools
(NASA-TM-85493; NAS 1.15:85493) Avail: NTIS HC A07/MF A01 CSCL 05I

The symposium included personal appearances by NASA astronauts, NASA exhibits, aerospace science lecture demonstrations (Spacemobile Lectures), souvenir photos for each student attending the symposium, and talks on job opportunities in aerospace and on the benefits of the Space Program. The program was directed mainly at (public, parochial and private) student groups, each of which spend three hours on the CCC campus to participate in the symposium activities. The symposium was open to the general public and consisted of the NASA exhibits, aerospace science lecture demonstrations, films, talks on the benefits of the space program, additional lectures by members of the American Institute of Aeronautics and Astronautics (AIAA), and a special tasting demonstration of space food meal systems. Author

N84-16021*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHICAGO MEETS OUTER SPACE PROGRAM Summary Report
Harrison Allen, Jr. 8 Oct. 1978 112 p refs Symp. held at Chicago, 1-8 Oct. 1978
(NASA-TM-85492; NAS 1.15:85492) Avail: NTIS HC A06/MF A01 CSCL 05I

The symposium included personal appearances by NASA astronauts, NASA exhibits, souvenir photos for each student attending the symposium, live demonstrations of how the Communication Technology Satellite links the U. S. with people around the world, and talks on job opportunities in aerospace and on the benefits of space. Monday through Friday, the program was directed mainly at (public, parochial and private) student groups, each of which spent a half day on the CSU campus to participate in the symposium activities. On Saturday and Sunday, the symposium was open to the general public and consisted of the NASA exhibits, films, a shorter version of the lectures and a special demonstration and tasting opportunity of space food meal systems. These quick meal systems that were designed for senior citizens. Author

N84-16022*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
RESEARCH REPORTS: 1983 NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM
Gerald R. Karr, James B. Dozier, (NASA. Marshall Space Flight Center), Leroy Osborn, (NASA. Marshall Space Flight Center), and Michael Freeman Dec. 1983 891 p refs Fellowship program held in Huntsville, Ala., 6 Jun. - 12 Aug. 1983
(Grant NGT-01-005-021)
(NASA-CR-170942; NAS 1.26:170942) Avail: NTIS HC A99/MF A01 CSCL 05I

Thirty-five technical reports contain results of investigations in information and electronic systems; materials and processing; systems dynamics; structures and propulsion; and space sciences. Ecology at KSC, satellite de-spin, and the X-ray source monitor were also studied. For individual titles, see N84-16023 through N84-16057.

N84-16023*# Alabama A & M Univ., Huntsville. Dept. of Engineering Technology.
LOGIC SIMULATOR PROGRAM c61
R. K. Agarwal *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 11 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 09B

The source code for the SPICE 2 program was deblocked in order to isolate and compile the subroutine in an effort to provide a software simulation of discrete and combinatorial electronic components. Incompatibilities between the UNIVAC 1180 FORTRAN and the Sigma V CP-V FORTRAN 4 were resolved. The SPICE 2 model is to be used to determine gate and fan-out delays, logic state conditions, and signal race conditions for transistor array elements and circuit logic to be patterned in the (SPI) 7101 CMOS silicon gate semicustom array. The simulator is to be operable from the CP-V time sharing terminals. A.R.H.

N84-16024*# Alabama Univ., Huntsville. Dept. of Mathematics.
THE GENERALIZED EULER-MASCHERONI CONSTANTS c64
R. Ainsworth *In its* Res. Rept.: NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 13 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 12A

The values of the first 32 constants are derived and listed in tables. A.R.H.

N84-16025*# Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
ANALYTICAL AND NUMERICAL SOLUTION FOR A SOLIDIFYING LIQUID ALLOY SLAB c26
Basil N. Antar *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 13 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11F

Numerical and analytical solutions are presented for the temperature and concentration distributions during the solidification of a binary liquid alloy slab. The slab is taken to be of a finite depth but infinite in the horizontal direction. The solidification process is started by withdrawing a fixed amount of heat from the lower surface of the slab. The upper surface of the slab is subjected to both radiation and convective conditions. The solution gives the concentration and temperature profiles and the interface

position as a function of time. Due to the smallness of the mass diffusion coefficient in the solid, the numerical solution method breaks down whenever the ratio of the diffusivities in the solid and the liquid falls below a certain value. An analytical method is developed which gives accurate solution for any value of the diffusivity ratio. Author

N84-16026*# Auburn Univ., Ala. Dept. of Physics.
HYDROGEN IGNITION FOR LASER PROPULSION c36
Raymond F. Askew *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 22 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20E

The breakdown of hydrogen by pulsed CO2 laser radiation to determine if reliable ignition of hydrogen could be achieved in the pressure range of 0.5 to 3.0 atmospheres is discussed. A nominal 100 nanosecond, 6 joule CO2 TEA laser pulse was used. Streak and framing photography, together with spectroscopic techniques and energy measuring devices determined the spatial and temporal behavior of the plasma size, shape, velocity, temperature, electron density and absorption. Reliable ignition was achieved with reproducible plasma behavior. A.R.H.

N84-16027*# Jackson State Univ., Miss. Dept. of Biology.
A PRELIMINARY SURVEY OF PLANKTON AND PERIPHYTON IN THE TURN BARGE CANAL AND BASIN AREA OF KENNEDY SPACE CENTER, FLORIDA c51
Grover D. Barnes *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship program Dec. 1983 26 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 06C

While thirty-seven species of various groups of organisms were identified at the five stations at KSC, further sampling is needed to further enumerate and identify phytoplankton and periphyton for the long term monitoring program and assessment for a probable polygeneration site. Thallophyta, Cyanophyta coccoid and Chrysophyta pennate were the dominant organisms. Chlorobium was the most abundant Thallophyta. Pennate diatoms were larger and more abundant at station one. The absence of Skeletonema costatum was surprising. Stations four and five appear to be acid marsh swales. Rhabdoderma lineare, a Cyanophyta coccoid found in acid lakes, was abundant in stations four and five. A.R.H.

N84-16028*# Alabama Univ., Huntsville. Dept. of Industrial and Systems Engineering.
REFLECTANCE MEASUREMENTS, PART 2 c75
Robert A. Brown *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 28 p (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20F

Improving the productivity of spectroreflectometer readings taken to monitor induced contamination of lenses, mirrors, and coatings in the space environment are described. More sophisticated modelling techniques were applied to the laboratory data collected last summer in order to produce a more accurate model of the nonlinearities and noise sources of the instrumentation. This would ultimately allow for correction of known anomalies by the digital computer, yielding an anticipated order to magnitude improvement in the accuracy of the reflectance measurements, while reducing the total measuring time. The construction of and programming for a modernized version of the electronics used in Beckman DK-2 spectroreflectometers suffered because of a schedule lag in fabrication of a modified form of the carrier frequency pickoff. Separate development of the electronics and the computer programming was partially accomplished. A.R.H.

N84-16029*# Texas A&M Univ., College Station. Dept. of Meteorology.
INVESTIGATION OF THE ARC CLOUD COMPLEX c47
Kenneth C. Brundidge *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 27 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 04B

Thunderstorm gust fronts, frequently identifiable as arc clouds, are recognized as triggering mechanisms for new convective activity at points of intersections. Arc clouds are recognizable as such only by high resolution meteorological satellite observations and may take on several configurations, depending upon the circumstances. A situation in which an arc cloud is associated with a large convective area is called an arc cloud complex. Several arc cloud complex cases are analyzed based upon a combination of satellite, radar and conventional meteorological observations. The circumstances which led to the development of the arc clouds and their subsequent impact upon their environment are discussed. A.R.H.

N84-16030*# Alabama A & M Univ., Huntsville. Dept. of Chemistry.
PARTIAL ANALYSIS OF INSTA-FOAM c27
Libby W. Chou *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 30 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11G

Insta-Foam, used as a thermal insulator for the non-critical area of the external tank during the prelaunch phase to minimize icing, is a two-component system. Component A has polyisocyanates, blowing agents, and stabilizers; Component B has the polyols, catalysts, blowing agents, stabilizers and fire retardant. The blowing agents are Freon 11 and Freon 12, the stabilizers are silicone surfactants, the catalysts are tertiary amines, and the fire retardant is tri-(beta-chloro-isopropyl) phosphate (PCF). High performance liquid chromatography (HPLC) was quantitatively identified polyols and PFC. A.R.H.

N84-16031*# Georgia Inst. of Tech., Atlanta. School of Mathematics.
MECHANICAL PROPERTY CHARACTERIZATION OF F-100/934 GRAPHITE-EPOXY COMPOSITE MATERIAL c24
Raymond G. Clinton, Jr. *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 28 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11D

Procedures for quality control, fabrication techniques, specimen machining, test methodologies, and data collection and interpretation were defined using Thornel P-100 carbon fiber combined with Fiberite's 934 epoxy resin in unidirectional tape form. Tests on the prepreg material, including gel time, resin solids content, tack, volatile content, and flow are detailed. The steps of the fabrication and machining processes are described. Both destructive and nondestructive techniques were employed to assess the properties of the cured laminates. Tests to determine tensile strength and modulus, compressive strength and modulus, interlaminar and inplane shear strength, and flexural strength and modulus are discussed. The results of these experiments are compared with data generated by other researchers. A.R.H.

N84-16032*# Mississippi State Univ., State College. Dept. of Physics.
PRELIMINARY DESIGNS FOR MODIFICATIONS TO THE X-RAY SOURCE AND BEAM MONITOR OF THE MARSHALL SPACE FLIGHT CENTER'S X-RAY CALIBRATION FACILITY c09
W. L. Croft *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 21 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 14B

Preliminary designs for modifications to the X-ray source and beam monitor of the MSFC X-Ray Calibration Facility to meet requirements for the calibration of the Advanced X-Ray Astrophysics Facility are considered. A rhodium plated copper target and rhodium foil filter are proposed as a source of X-rays of approximately 2.6 keV energy. Bragg scattering of the unpolarized X-ray beam from the present source through an angle of 90 deg by a single crystal placed on the axis of the guide tube is proposed as a source of approximately monoenergetic plane polarized X-rays. A sealed xenon proportional counter with a Beryllium window is

proposed as a beam monitor for use between 2.5 and 8 keV to obtain improved detection efficiency. Author

N84-16033*# Tennessee Technological Univ., Cookeville. Dept. of Chemistry.
SYNTHESIS OF N-SUBSTITUTED SILANEAMINES: MONOMERIC PRECURSORS OF SILICON CARBIDE-NITRIDE FIBERS **c27**
David J. Crouse *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 21 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11G

Silanetriamines are prepared by the condensation of methyl or phenyl trichlorosilane with a primary amine. The amines used were methyl, n-propyl, n-butyl and allyl. The silaneamines were prepared by adding the chlorosilane to a solution of the amine in either petroleum ether or toluene. The compounds were purified by distillation and characterized by infrared and nuclear magnetic resonance spectroscopy. A.R.H.

N84-16034*# Auburn Univ., Ala. Dept. of Mathematics.
LINEAR AND NONLINEAR ASPECTS OF ROTORDYNAMICS **c37**
William B. Day *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 22 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 13I

Excessive vibrations of the liquid oxygen pump in the Space Shuttle's Main Engine have been recorded during hot firing ground testing. In order to determine mathematical explanations of this possibility, destructive phenomenon differential equations have been examined which describe the rotordynamics of the pump. Modeling the rotor as a random eigenvalue problem was considered. Analytical expressions were derived for the solution in the case of symmetric damping and stiffness. This enables one to determine accuracy estimates when testing numerical techniques to solve both asymmetric and nonlinear problems. Finally, the rotor model has had nonlinear elements incorporated to improve its simulation of the pump and to expand the corresponding mathematical theory. B.W.

N84-16035*# North Georgia Coll., Dahlonega. Dept. of Physics.
INTERFACING A TWO-STAGE IMAGE INTENSIFIER TUBE TO AN ECHELLE SPECTROGRAPH **c74**
Terry R. Flesch *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 16 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20F

An Echelle spectrograph has been in use at the Marshall Space Flight Center for a number of years. Research has been carried out in the study of the internal motions of ionized gas clouds in the interstellar medium. In order to extend the ability of the spectrograph to allow investigations of the faint outer regions of the gas clouds and to make possible the initiation of new research programs dealing with the study of sunspots and the zodiacal light, a two-stage image intensifier tube was incorporated into the instrument. The objective of this work was to interface the image tube with the spectrograph. Author

N84-16036*# Auburn Univ., Ala. Dept. of Physics.
ATOMIC OXYGEN EFFECTS ON MATERIALS **c26**
Albert T. Fromhold *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 31 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11F

One objective of this investigation has been to offer recommendations on the selection of metal samples to be exposed to ambient atomic oxygen on the STS-8 flight presently scheduled for August 30, 1983. (These samples constitute a small subgroup of a very large group of test specimens prepared by A. Whitaker and other members of the Physical Sciences Branch for this mission.) The metals selected and prepared for STS-8 are silver, lead, copper, nickel, tungsten, molybdenum, magnesium, platinum, and alloys of FeCrAl and NiCr. Literature data are reviewed concerning the oxidation properties of these materials with a view towards understanding which oxides might be formed, the state of the oxide (surface film or volatile form), and the reaction rate. In addition, various techniques for characterizing the parent metals and the surface oxides are reviewed. Author

N84-16037*# Mississippi State Univ., State College. Dept. of Chemical Engineering.
AN EVALUATION OF TECHROLL SEAL FLEXIBLE JOINT MATERIAL **c27**
William B. Hall *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 18 p (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11A

This study evaluated the materials utilized in the flexible joint for possible failure modes. Studies undertaken included effect of temperature on the strength of the system, effect of fatigue on the strength of the system, thermogravimetric analysis, thermochemical analysis, differential scanning calorimeter analysis, dynamic mechanical analysis, and peel test. These studies indicate that if the joint failed due to a materials deficiency, the most likely mode was excessive temperature in the joint. In addition, the joint material is susceptible to fatigue damage which could have been a contributing factor. B.W.

N84-16038*# Alabama Univ., Huntsville. Dept. of Physics and Astronomy.
A STUDY OF ACCRETION IN COMPACT SOURCES: DISK PRECESSION AND JET HELICITY **c34**
Philip E. Hardee *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 39 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20D

The effect of adiabatic expansion on the propagation and growth of helical twisting on a supersonic jet is investigated. Cooling of the jet material increases the jet's Mach number and increases the jet's density relative to that of the external medium. This has the effect of decreasing the maximum rate of growth and increasing the maximally unstable wavelength relative to the jet's radius. Propagation effects cause the wavelength of helical waves to change at a rate different from that of the maximally unstable wavelength with the result that the characteristic wavelength of helical twisting is not equal to this wavelength. The most rapidly growing helical wave will have a wavelength as much as a factor of 2 different from the instantaneous maximally unstable wavelength. B.W.

N84-16039*# Alabama Univ., Huntsville. Dept. of Electronic Engineering Technology.
CHARACTERISTICS OF RF LIGHTNING EMISSION AT 2 GHz AND 250 MHz **c32**
Fereydoun Jalali *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 20 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20N

Radio frequency emissions in the S-band and VHF range from lightning discharges are recorded by a facility developed at MSFC as part of a feasibility study of a satellite-based lightning mapping system. The recording facility receives RF emissions in both vertical and horizontal polarization and stores the data on magnetic tape. Output from any one antenna may also be selected for high speed digitization and disk storage. Improvement in both hardware and software have enhanced significantly the accuracy of data characterization and the speed of data collection. Emission records at VHF have higher signal strength than the S-band as expected. The records of cloud-to-ground discharges obtained so far give a 7-33 V/M peak equivalent signal strength (1 KHz at 10 kilometer) in the S-band range. The CG discharge structure is recognizable in most of the data collected. Considerable RF activity is present throughout the VHF records. The S-band data shows signals associated with limited portions of discharge history. The

records obtained are from lightning activities within a 10 mile range. Author

N84-16040*# Kentucky Univ., Lexington. Dept. of Electrical Engineering.
A FEASIBILITY STUDY OF ELECTROMAGNETIC DE-SPIN SYSTEM FOR EARTH ORBITING SATELLITES c15
Prasad K. Kadaba *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 33 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 22B

This investigation is a feasibility study of electromagnetic satellite de-spin systems based on induced eddy-currents in the satellite by an external dc magnetic field. Two concepts have been investigated: (1) one based on a large diameter coil positioned around the satellite such that the axis of the satellite rotation is in the plane of the coil; and (2) a magnet, either permanent or electromagnet, positioned close to the satellite by the orbiter RMS. A comparison is made of the two concepts by varying the appropriate parameters with a view to reduce the de-spin time to a reasonable value. Design parameters for the magnets and the coil are indicated. Author

N84-16041*# University of Eastern Kentucky, Richmond. Dept. of Physics and Astronomy.
STUDIES OF NEUTRON AND PROTON NUCLEAR ACTIVATION IN LOW-EARTH ORBIT 2 c72
C. E. Laird *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 25 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20H

The study of neutron and proton nuclear activation in low-Earth orbit reported in NASA CR-162051 has been continued with increasing emphasis given to primary and secondary neutron activation. The previously reported activation due to protons has been modified to include: (1) flux attenuation caused by all inelastic reactions; (2) the modification of the proton flux distribution caused by sample covering material; and (3) the activation of the sample as a function of the distance into the sample from the surface of incidence. A method has been developed for including the effects on the activation of the finite width and length of the samples. The reactant product spectra produced by proton-induced reactions has been studied. Cross sections needed for neutron induced reactions leading to long-lived (half-life > 1 day) radioisotopes have been identified and, in some cases, compiled. B.W.

N84-16042*# Tuskegee Inst., Ala. Dept. of Chemistry.
ULTRAHIGH MOLECULAR WEIGHT AROMATIC SILOXANE POLYMERS c27
Larry M. Ludwick *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 13 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11G

Silphenylene-siloxane polymers can be prepared by a condensation reaction of a diol [1,4-bis(hydroxydimethylsilyl)benzene] and a silane [bis(dimethylamino)dimethylsilane]. Using a stepwise condensation technique, a polymer (R=CH3) with a molecular weight in excess of 1.0 x 1 million has been produced. The polymer exhibits increased thermal stability, compared to a methyl siloxane polymer without the aromatic phenyl ring in the backbone. The use of bis(dimethylamino)methylvinylsilane should allow for ready crosslinking at the vinyl sites (R=-CH=CH2) introduced into the backbone. However, under the conditions of the reaction system a high molecular weight polymer was not obtained or the polymer underwent a crosslinking process during the synthesis. B.W.

N84-16043*# Middle Tennessee State Univ., Murfreesboro. Dept. of Chemistry and Physics.
A REPORT ON SUPERFLUID HELIUM FLOW THROUGH POROUS PLUGS FOR SPACE SCIENCE APPLICATIONS c34
Franklin Curtis Mason *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 20 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20D

As a background for the study of the nature of superfluid helium flow through porous plugs for other space science uses, preliminary tests on various plugs of a given material, diameter, height, and filtration grade have been performed. Two characteristics of the plugs, pore size and number of channels, have been determined by the bubble test and warm flow test of helium gas through the plugs, respectively. Tests on the flow of He II through the plugs have also been performed. An obvious feature of the results of these tests is that for isothermal measurements of pressure versus mass flow rate below approximately 2.10 K, the flow is separated into two different regimes, indicative of the occurrence of a critical phenomenon. B.W.

N84-16044*# Middle Tennessee State Univ., Murfreesboro.
POPULATION CONTROL OF SELF-REPLICATING SYSTEMS: OPTION C c64
Richard L. McCord *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 16 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 12A

From the conception and development of the theory of self-replicating automata by John von Neumann, others have expanded on his theories. In 1980, Georg von Tiesenhausen and Wesley A. Darbro developed a report which is a 'first' in presenting the theories in a conceptualized engineering setting. In that report several options involving self-replicating systems are presented. One of the options allows each primary to generate n replicas, one in each sequential time frame after its own generation. Each replica is limited to a maximum of m ancestors. This study involves determining the state vector of the replicas in an efficient manner. The problem is cast in matrix notation, where F = [fij] is a non-diagonalizable matrix. Any element fij represents the number of elements of type j = (c,d) in time frame k+1 generated from type i = (a,b) in time frame k. It is then shown that the state vector is: bar F(k)=bar F (non-zero) X F sub K = bar F (non-zero) xmx J sub kx m sub-1 where J is a matrix in Jordan form having the same eigenvalues as F. M is a matrix composed of the eigenvectors and the generalized eigenvectors of F. Author

N84-16045*# Berry Coll., Mount Berry, Ga. Dept. of Physics.
A FMCW RADAR RANGING DEVICE FOR THE TELEOPERATOR MANEUVERING SYSTEM c32
Malcolm W. McDonald *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 15 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 17I

A frequency-modulated continuous wave radar system is under development in the Communications Systems Branch of the Information and Electronic Systems Laboratory at Marshall Space Flight Center. The radar unit is being designed for use on the teleoperator maneuvering system. Its function is to provide millimeter-level accuracy in range and range rate measurements out to a range of thirty meters. This will facilitate soft docking with accuracy. This report is an updating of previous developments reported on this system. An innovation in the system is the utilization of a standard reference signal generated by shunting a portion of the radar energy into a shorted coaxial delay line. The regular radar target return signal is constantly compared with the reference signal to provide internal error compensation. Within a five meter range, a limit imposed by present laboratory dimensions, the radar system exhibits reliable accuracy with range error less than 0.2%. Author

N84-16046*# Tennessee Univ. Space Inst., Tullahoma. Dept. of Electrical Engineering.
THE DEVELOPMENT OF A DIGITAL PROCESSING SYSTEM FOR ACCURATE RANGE DETERMINATIONS c32
Alfonso Pujol, Jr. *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 13 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 17I

The development of an accurate close range (from 0.0 meters

to 30.0 meters) radar system for Teleoperator Maneuvering Systems (TMS) is discussed. The system under investigation is a digital processor that converts incoming signals from the radar system into their related frequency spectra. Identification will be attempted by correlating spectral characteristics with accurate range determinataions. The system will utilize an analog to digital converter for sampling and converting the signal from the radar system into 16-bit digital words (two bytes) for RAM storage, data manipulations, and computations. To remove unwanted frequency components the data will be retrieved from RAM and digitally filtered using large scale integration (LSI) circuits. Filtering will be performed by a biquadratic routine within the chip which carries out the required filter algorithm. For conversion to a frequency spectrum the filtered data will be processed by a Fast Fourier Transform chip. Analysis and identification of spectral characteristics for accurate range determinations will be made by microcomputer computations. M.G.

N84-16047*# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
SENSOR CONTROL OF ROBOT ARC WELDING c37
Fred R. Sias, Jr. *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 56 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 13I

The potential for using computer vision as sensory feedback for robot gas-tungsten arc welding is investigated. The basic parameters that must be controlled while directing the movement of an arc welding torch are defined. The actions of a human welder are examined to aid in determining the sensory information that would permit a robot to make reproducible high strength welds. Special constraints imposed by both robot hardware and software are considered. Several sensory modalities that would potentially improve weld quality are examined. Special emphasis is directed to the use of computer vision for controlling gas-tungsten arc welding. Vendors of available automated seam tracking arc welding systems and of computer vision systems are surveyed. An assessment is made of the state of the art and the problems that must be solved in order to apply computer vision to robot controlled arc welding on the Space Shuttle Main Engine. M.G.

N84-16048*# Alabama Univ., Huntsville. Dept. of Mathematics.
STATISTICAL ANALYSIS OF A DEBUGGING MODEL c64
Kyle Siegrist *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 24 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 12A

Suppose that a system is undergoing a sequence of trials and design changes in an effort to find and eliminate design flaws in the system. Specifically, suppose that each trial is classified as an assignable cause failure (if the failure is due to one or more design flaws), an inherent failure (if the failure is not due to a design flaw), or a success. After each assignable cause failure, the design flaws that caused the failure are removed. In the case of statistically independent and identical design flaws, a probabilistic model is developed to describe this debugging process. Explicit expressions are obtained for the distributions of the important random variables and for the important measures of reliability. Statistical methods are developed for estimating the parameters of the model from accumulated test data. Author

N84-16049*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
A NUMERICAL INVESTIGATION OF THE MULTIPLE VORTEX PHENOMENON: VORTEX NUMBER AND STRUCTURE AS A FUNCTION OF SWIRL RATIO c34
David R. Smith *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 28 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20D

A numerical investigation of the multiple vortex phenomenon (MVP) for tornado like flows is conducted to determine the conditions for when a vortex becomes unstable and divides into smaller subsidiary vortices, as well as to determine the structure of these vortices. A three dimensional numerical model developed by Rotunno (1983) is utilized which has been demonstrated to successfully simulate MVP with properties observed both in natural as well as laboratory tornado like vortices. The MVP is generated for several swirl ratio conditions in order to determine the number of vortices generated for those flow configurations. These results are then compared to experimental measurements to validate the numerical model. The number of vortices produced is consistent with observational results made in the Purdue tornado vortex chamber. Furthermore, horizontal and vertical cross sections are taken through the vortices to determine the structure of MVP. Preliminary results indicate that tangential velocities within these smaller asymmetric vortices increase by 20% over values observed in a single axisymmetric vortex at the same swirl ratio. M.G.

N84-16050*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
DETERMINATION OF SYSTEMS SUITABLE FOR STUDY AS MONOTECTIC BINARY METALLIC ALLOY SOLIDIFICATION MODELS c26
James E. Smith, Jr. *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 24 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 11F

Succinonitrile-water and diethylene glycol-ethyl salicylate are two transparent systems which have been studied as monotectic binary metallic alloy solidification models. Being transparent, these systems allow for the direct observations of phase transformations and solidification reactions. The objective was to develop a screening technique to find systems of interest and then experimentally measure those systems. The succinonitrile-water system was used to check the procedures. To simulate the phase diagram of the system, two computer programs which determine solid-liquid and liquid-liquid equilibria were obtained. These programs use the UNIFAC method to determine activity coefficients and together with several other programs were used to predict the phase diagram. An experimental apparatus was developed and the succinonitrile-water phase diagram measured. The diagram was compared to both the simulation and literature data. Substantial differences were found in the comparisons which serve to demonstrate the need for this procedure. M.G.

N84-16051*# Kansas Univ., Lawrence. Dept. of Electrical Engineering.
COMPUTER CONTROL OF A SEVEN DEGREE OF FREEDOM MANIPULATOR ARM c54
John Stensby *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 33 p (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 08H

An algorithm for the computer control of a seven degree of freedom manipulator arm, termed the Hawk Control Mode, is described. The algorithm is segmented into two distinct parts. One part controls the extension, azimuth, and elevation of the wrist joint. The second part controls the attitude of the terminal device. The two segments interact to achieve decoupling of wrist joint translation and terminal device rotation. M.G.

N84-16052*# Alabama Univ., Huntsville.
ORBITAL MANEUVERING VEHICLE SIMULATION SYSTEM ON-BOARD PROCESSING LOGIC c18
William Teoh *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 67 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 22A

The control logic for an Orbital Maneuvering Vehicle (OMV) Simulation system is developed. In order that better control over the vehicle can be exercised, several modifications to the vehicle are suggested. The need of better position feedback leads to the development of an alternative simpler but more reliable navigation system which is also discussed. The control logic is presented in

pseudocode form, and can be implemented in FORTRAN and/or MACRO II. Author

N84-16053*# Alabama A & M Univ., Normal. Materials and Processing Lab.
LABORATORY AUTOMATION OF A QUADRUPOLE MASS SPECTROMETER **c35**
James M. Thompson *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 26 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 14B

Efforts directed toward interfacing an LSI II bus of a PDP 11/23 desktop computer with a quadrupole mass spectrometer for the purpose of providing a convenient system whereby mass spectral data, of the products of thermal decomposition, may be rapidly acquired and processed under programmed conditions are described. The versatility and operations of the quadrupole mass spectrometer are discussed as well as the procedure for configurating the LSI II bus of the PDP 11/23 desktop computer for interfacing with the quadrupole mass spectrometer system. Data from the mass filter and other units of the spectrometer are digitally transferred to the computer whereupon mass spectral data and related data are generated. M. G.

N84-16054*# Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.
STIFFNESS PROPERTIES FOR DYNAMIC MODELING OF COMPOSITE GRAPHITE-EPOXY CYLINDRICAL ORTHOTROPIC SHELLS **c39**
R. Noel Tolbert *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 34 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20K

Traditional composite lamination theory was used to predict composite graphite-epoxy laminate stiffnesses for comparison to quasi-experimental stiffnesses developed from cylindrical bottle pressure testing. Stiffness sensitivities were examined for variations in constituent materials and geometric properties. The material component interactions examined were the fiber longitudinal and transverse Young's modulus, the fiber shear modulus and primary Poisson's ratio, the resin Young's modulus, shear modulus, and Poisson's ratio. The geometric variation of the helical winding angle was also examined. Two computer programs were written to generate the data used to demonstrate the stiffness variations. M.G.

N84-16055*# Alabama A & M Univ., Huntsville. Dept. of Physics.
COMPOSITIONAL SEGREGATION IN UNIDIRECTIONALLY SOLIDIFIED SOLID SOLUTION CRYSTALS **c76**
Jai-Ching Wang *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 32 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20B

A computer program was developed to model compositional segregation in unidirectionally solidified solid-solution-semiconducting crystals. The program takes into account the variations of the interface segregation constant and solidification rate with composition. Calculations are performed for the HgCdTe solid solution system that is compared with experimental data. Author

N84-16056*# Alabama Univ., Huntsville. Dept. of Aerospace Engineering.
FINITE ELEMENT ANALYSIS OF A DEPLOYABLE SPACE STRUCTURE **c39**
George E. Weeks *In its* Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 24 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 20K

The dynamic characteristics of the Solar Array Flight Experiment (SAFE) structure during deployment and retraction are investigated. The SAFE structure consists of a deployable mast with an attached solar blanket designed with accordion type folds to permit packaging in a small volume. The planar form of the blanket geometry during deployment is maintained by a blanket tension/guidewire system. Structurally, the mast is modeled as an Euler beam column with inplane and out of plane bending and finite torsional stiffness. For out of plane motion, the blanket is modeled as a distributed mass uniformly supported by the three guidewires. For inplane motion the blanket displacements are assumed to vary linearly from the mast base to the mast tip. The mathematical model uses a virtual work formulation, required because the axial loading on the mast is nonconservative, combined with assumed beam modes to derive the differential equations of motion. Consideration of the time dependent boundary conditions results in an infinite set of ODE with time dependent coefficients. Finally, correlation of mast tip accelerations to mast base bending moments for specified modal motions are indicated. M.G.

N84-16057*# Calhoun Community Coll., Decatur, Ala.
EVALUATION OF THE SEPARABILITY OF MONODISPERSE POLYSTYRENE LATEX MICROSPHERES IN A CONTINUOUS FLOW ELECTROPHORESIS SYSTEM **c25**
George Williams, Jr. *In* Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program Dec. 1983 16 p refs (For primary document see N84-16022 06-80)
Avail: NTIS HC A99/MF A01 CSCL 07D

The continuous flow electrophoresis system makes electrophoresis possible in a free flowing film of aqueous electrolyte medium. The sample is introduced at one end of the chamber and is subjected to a lateral dc field. This process separates the sample into fractions since each component has a distinctive electrophoric mobility. Evaluations were made of sample conductivity and buffer conductivity as they affect sample band spread and separation using the Continuous Particle Electrophoresis (CPE) system. Samples were prepared from mixtures of 5 percent and 1 percent polystyrene latex (PSL) microspheres which were .4, .56 and .7 microns in diameter. These were prepared in electrolyte media 1x and 3x the conductivity of the curtain buffer, approximately 150 and 450 micro mhos/cm. Samples with matched conductivities produced greater resolution and less band spread than those with 3x the conductivity of the curtain buffer. M.G.

N84-16058# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIRST UFO INCIDENT FOR OUR COUNTRY
Ruyi Long 9 Sep. 1983 6 p Transl. into ENGLISH from Hangtian (China), no. 4, 1982 p 12-13
(AD-A133326; FTD-ID(RS)T-1019-83) Avail: NTIS HC A02/MF A01 CSCL 01/2

The possibility the flying object observed by 10,000,000 people in the Sichuan and Yunnan provinces of China during a 6 to 7-minute period was a spy plane is advanced. A.R.H.

N84-16059# University of Southern California, Los Angeles. Center for Effective Organizations.
PERFORMANCE APPRAISAL REVISITED
Edward E. Lawler, III , Allan M. Mohrman, Jr., and Susan M. Resnick Mar. 1983 27 p
(Contract N00014-81-K-0048)
(AD-A132841; G-83-7-(38); TR-11) Avail: NTIS HC A03/MF A01 CSCL 05/9

This report examines a series of studies concerned with performance appraisal effectiveness. It identifies those conditions which are associated with effective appraisals and the relationship between such things as pay discussions and performance appraisal effectiveness. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N84-16060*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

CHRONOLOGY OF KSC AND KSC RELATED EVENTS FOR 1981
1 Sep. 1983 408 p
(NASA-TM-85510; KHR-6; NAS 1.15:85510) Avail: NTIS HC A18/MF A01 CSCL 05A

A record of aerospace and related activities in 1981 in which the John F. Kennedy Space Center had prominent involvement and interest is presented. Articles were selected from newspapers and other periodicals. Intended as a reference source or historians and other researchers, the document is arranged by month and items by date of the published sources. A.R.H.

N84-16061# University of Southern California, Los Angeles. Center for Effective Organizations.
INCENTIVES FOR CONTROLLING THE PERFORMANCE OF HIGH TECHNOLOGY AND PROFESSIONAL EMPLOYEES
Mary Ann VonGlinow 1983 23 p
(Contract N00014-81-K-0048)
(AD-A134074; G-83-3-(34); TR-15) Avail: NTIS HC A02/MF A01 CSCL 05/11

Problems arise from potential incompatibilities between characteristics of high technology and professional employees and traditional organizational authority and control systems. These incompatibilities may lead to dysfunctional conflict between role expectations of professionals and organizational requirements. Some organizations are attempting to deal with the conflict by designing evaluation and control systems which better reflect the expectations of the highly skilled employee. Paper identifies sources of tension for professional and attempts to illustrate how it may be lessened by aligning the professional expectation with organizational goals. Recommendations are offered for differential incentives and rewards. Author (GRA)

N84-16062# Midwest Research Inst., Kansas City, Mo. Economic and Social Sciences Dept.
APPRAISAL OF SCIENTIFIC RESOURCES FOR EMERGENCY MANAGEMENT Final Report, 30 Sep. 1982 - 31 Aug. 1983
Edward W. Lawless and Deborah M. Smith Sep. 1983 116 p
(Contract EMW-C-0835; MRI Proj. 7541-D)
(AD-A133285) Avail: NTIS HC A06/MF A01 CSCL 05/1

The scientific and technological information needs, capabilities and resources of the Federal Emergency Management Agency were evaluated through a combination of approaches. These included: a review of prior research on the informational needs of emergency and disaster response agencies; case studies of selected previous disasters and emergencies; analyses of FEMA's mission and roles; surveys and interviews with selected FEMA staff regarding capabilities, practices and needs; and contacts with several other government agency and private sector resources involved in emergency and disaster responses. Several options are suggested for improving FEMA's scientific and technological information capabilities to meet its needs. These include: improving the presently existing system of personal contacts; improving directories of emergency and disaster response resources; developing a Science Resource Information System; developing a National Emergency Science Reserve; and preparing critical reviews of available information in selected areas. GRA

N84-16063# Carnegie-Mellon Univ., Pittsburgh, Pa. Lab. for Intelligent Systems.
ISIS: A CONSTRAINT-DIRECTED REASONING APPROACH TO JOB SHOP SCHEDULING Interim Report
Mark S. Fox, Bradley P. Allen, Stephen F. Smith, and Gary A. Strohm 21 Jun. 1983 25 p Presented at the Conf. on Trends and Applications, Gaithersburg, Md., May 1983
(Contract F49620-82-K-0017)
(AD-A133296; CMU-RI-TR-83-8) Avail: NTIS HC A02/MF A01 CSCL 05/1

Analysis of the job shop scheduling domain has indicated that the crux of the scheduling problem is the determination and satisfaction of a large number and variety of constraints. Schedules are influenced by such diverse factors as due date requirements, cost restrictions, production levels, machine capabilities, operation precedences, resource requirements, and resource availability. This paper describes ISIS, a scheduling system capable of incorporating all relevant constraints in the construction of job shop schedules. The authors examine both the representation of constraints within ISIS, and the manner in which these constraints are utilized in conducting a constraint-directed search for an acceptable schedule. The important issues relating to the relaxation of constraints are addressed. Finally, the interactive scheduling facilities provided by ISIS are considered. Author (GRA)

N84-16064# RAND Corp., Santa Monica, Calif.
PERSPECTIVES ON OVERSIGHT MANAGEMENT OF SOFTWARE DEVELOPMENT PROJECTS Interim Report
Willis H. Ware and Robert L. Patrick Jul. 1983 60 p
(Contract F49620-82-C-0018)
(AD-A133404; RAND/N-2027-AF) Avail: NTIS HC A04/MF A01 CSCL 05/1

This report examines the problems of oversight management of large, important software development projects, i.e., management at levels above that of direct project execution. Senior managers must recognize events in the evolution of the project that might provide high leverage for maximizing the return on their invested time (in knowledge, status, or outcome projections), and that provide insight into project status and clues about possible problems. The note attempts to identify the unique needs of oversight managers, to indicate how they have been met in industrial environments, to enumerate what working supervisors and project managers must do differently if they are involved with large projects requiring oversight management, and to list what must be done (generally) to build software tools that supply information for oversight management as a by-product of the development process. While the discussion is based on industrial experience, it is also relevant to Air Force oversight management and review. GRA

N84-16065# California Univ., Berkeley.
PRODUCTION NETWORKS: A DYNAMIC MODEL OF PRODUCTION
Steven T. Hackman and Ronald W. Shephard Jun. 1983 31 p
(Contract N00014-76-C-0134; NR Proj. 047-033)
(AD-A133571; ORC-83-4) Avail: NTIS HC A03/MF A01 CSCL 05/3

This paper introduces the dynamic production network as a dynamic model of production which exhibits the real complexity underlying the simple treatments commonly used in economic analyses. The model reflects the truly dynamic character of production by illustrating directly the time substitutions of both input and output and modeling the intermediate product transfers explicitly. The abstract dynamic production network correspondence which relates input to output for this model is defined. From this, the concept of the technically efficient subset is introduced for which a proof of its non-emptiness is provided. The optimization problem that is used to obtain a technically efficient point can be used for resource allocation; a preliminary treatment is provided. Some limitations of the present model are also discussed. Author (GRA)

N84-16066# University of Southern California, Los Angeles. Center for Effective Organizations.
ORGANIZATIONAL OUTCOMES OF CREATIVITY
Mary Ann VonGlinow and Steven Kerr Jun. 1983 21 p
(Contract N00014-81-K-0048)
(AD-A132825; G-83-11-(42); 13) Avail: NTIS HC A02/MF A01 CSCL 05/1

It is an assumption not an established fact, that creative individuals and organizations are more productive in terms of commonly used financial and productivity criteria, and once an individual has become creative, the firm will benefit. However, descriptions of the organizational outcomes of this creativity is general and this paper has attempted to determine whether most

people have specifics in mind when speaking of these outcomes and the need for creativity in the organization. Author (GRA)

N84-16067# University of Southern California, Los Angeles. Center for Effective Organizations.
THE DESIGN OF EFFECTIVE REWARD SYSTEMS
Edward E. Lawler, III Apr. 1983 57 p
(Contract N00014-81-K-0048)
(AD-A132859; G-83-8-(39); TR-12) Avail: NTIS HC A04/MF A01 CSCL 05/1

Reward systems are one of the most prominent and frequently discussed features of organizations. This chapter will focus on the design choices that are involved in managing a reward system and their relationship to organizational effectiveness rather than on specific pay system technologies. The underlying assumption is that the reward system of an organization can be a key contributor to organizational effectiveness. However, for this to occur careful analysis needs to be made of the role that reward systems can and should play in the strategic plan of the organization. GRA

N84-16068# School of Aerospace Medicine, Brooks AFB, Tex.
ORGANIZATIONAL-CLIMATE DIMENSIONS: A CONCEPTUAL AND JUDGMENTAL ANALYSIS Final Report, Jan. 1980 - Dec. 1981
Grant E. Secrist, Vabian L. Paden, and Richard C. McNee Aug. 1983 19 p
(DA Proj. 7930)
(AD-A132898; SAM-TR-83-24) Avail: NTIS HC A02/MF A01 CSCL 05/1

Identifying salient climate dimensions and determining their generality across a variety of organizational settings are important aspects of the study of organizational climate. The purpose of this study was to determine the conceptual similarity among a sample of organizational variables and to ascertain the adequacy of a new seven-dimension organizational-climate taxonomy to account for these variables. Twelve judges independently classified 105 organizational variebles from 14 research investigation, using the new climate taxonomy. Nearly 70% of the 105 variables were classified within the framework of the climate taxonomy by a criterion of agreement of six or more judges. Complete classification agreement across all possible paris of judges was found for nearly 50% of the 105 variables. On the average, 7 of the 12 judges agreed on the classification of the 105 organizational variables. These findings demonstrate that considerable conceptual similarity exists among the types of organizational variables found in a sample of the research literature and that the new taxonomy has sufficient utility to warrant further development. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N84-16069 Purdue Univ., Lafayette, Ind.
A NEW TREATMENT OF INCOMPLETE INFORMATION AND RETRIEVAL IN RELATIONAL DATA BASES Ph.D. Thesis
Ramachandra Bhaskar Abhyankar 1983 168 p
Avail: Univ. Microfilms order No. DA8323947

A framework is introduced for the treatment of incomplete information in relational data bases. The framework includes a new knowledge representation scheme for representing incomplete information in a relational data base, new kinds of data dependencies and inference rules, new definitions and realizations of relational operators for the case of incomplete information, conditions for lossless decomposition of relations containing incomplete information and results on the retrieval of information from a small version of a data base containing incomplete information. A treatment based on the operators of possibility and necessity of the system S5 of modal logic is also presented. Techniques are offered for dealing with various of the information retrieval process. Dissert. Abstr.

N84-16070 Michigan Univ., Ann Arbor.
THE PERCEPTUAL COMPONENT OF RELATIONSHIPS IN LIBRARY NETWORKS Ph.D. Thesis
Charles Thomas Townley 1983 285 p
Avail: Univ. Microfilms Order No. DA8324299

The study investigated relationships between eligible libraries and the seven regional systems that makeup the Colorado Library Network. Mailed questionnaires were used to collect data on perceptions of mutual goal compatibility, agreement between organizations in the network, influence and quality of work as well as interaction rates and structural characteristics. Eighty-one percent (334) of 412 questionnaires were returned. Follow-up interviews were conducted with a stratified sample of 54 library and system directors. Data analysis included median and chi square tests. Variations in perception associated with structural characteristics were assessed. Structural characteristics included membership status, respondent type, length of membership, governing board status, system affiliation, library size and library type. Empirical tests identified symmetrical and asymmetrical relationships on the basis of perceived benefit. It was demonstrated that the highest interaction rates occur in relationships where both the library and the system director perceive benefit. Dissert. Abstr.

N84-16071*# Systems and Applied Sciences Corp., Hyattsville, Md.
FGGE/SBUV TAPE SPECIFICATION AND SHIPPING LETTER DESCRIPTION
Daesoo Han and Henry Lo Greenbelt, Md. NASA. Goddard Space Flight Center Mar. 1983 39 p
(Contract NAS5-26753)
(NASA-CR-170482; NAS 1.26:170482; SSD-T-4-8234-006-82) Avail: NTIS HC A03/MF A01 CSCL 05B

The FGGE/SBUV Level 2C data set consists of 12 9-track data tapes, each of which contains total ozone and ozone profile data for one calendar month grouped in files containing the data in a 6 hour synoptic time block. The data flow and quality checks in the production of this data set are described as well as the format of the data tapes and the accompanying shipping documents. A.R.H.

N84-16072*# Systems and Applied Sciences Corp., Hyattsville, Md.
FGGE/ERBM TAPE SPECIFICATION AND SHIPPING LETTER DESCRIPTION
Daesoo Han and Henry Lo Greenbelt, Md. NASA. Goddard Space Flight Center Mar. 1983 52 p
(Contract NAS5-27393)
(NASA-CR-170547; NAS 1.26:170547; SSD-T-8237-002-82) Avail: NTIS HC A04/MF A01 CSCL 05B

The Nimbus-7 FGGE/ERBM tape contains 27 ERB parameters which are extracted and reformatted from the Nimbus-7 ERB-MATRIX tape. There are four types of files on a FGGE/ERBM tape: a test file; tape-header file which describes the data set characteristics and the contents of the tape; a grid-descriptor file which contains the information of the ERB scanning channel target number and their associated latitude limits and longitude intervals; and one or more data files. A single end-of-file (EOF) tape mark is written after each file, and two EOF marks are written after the last data file on the tape. A.R.H.

N84-16073*# Systems and Applied Sciences Corp., Hyattsville, Md.
FGGE/ERBZ TAPE SPECIFICATION AND SHIPPING LETTER DESCRIPTION
Daesoo Han and Henry Lo Greenbelt, Md. NASA. Goddard Space Flight Center Mar. 1983 52 p
(Contract NAS5-26753)
(NASA-CR-170548; NAS 1.26:170548; SSD-T-8237-002-82) Avail: NTIS HC A04/MF A01 CSCL 05B

The FGGE/ERBZ tape contains 5 parameters which are extracted and reformatted from the Nimbus-7 ERB Zonal Means Tape. There are three types of files on a FGGE/ERBZ tape: a tape header file, and data files. Physical characteristics, gross format, and file specifications are given. A sample tape check/document printout (shipping letter) is included. A.R.H.

N84-16074*# Systems and Applied Sciences Corp., Hyattsville, Md.
FGGE/SMMR-30 TAPE SPECIFICATION AND SHIPPING LETTER DESCRIPTION
Daesoo Han and Henry Lo Mar. 1983 44 p
(Contract NAS5-26753)
(NASA-CR-170550; NAS 1.26:170550; SSD-T-8234-005-82) Avail: NTIS HC A03/MF A01 CSCL 05B

The Nimbus-7 FGGE/SMMR-30 tape which contains sea ice concentration data in 30 km resolution which are extracted and reformatted from Nimbus-7 SMMR PARM-30 tapes in accordance with the FGGE level II International Exchange Format Specification is outlined. There are three types of files on a FGGE/SMMR-30 tape. The first file on the tape is a test file. The second file on the tape is a tape header file. The remaining one or more files are data files. All files are terminated with a single end of file (EOP) tape mark. The last file is terminated with two EOF tape marks. All files are made up of one or more physical records. Each physical record contains 2960 bytes. Each data file contains all available values for a 6 hour synoptic time period. E.A.K.

N84-16075*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIGNIFICANT SCIENTIFIC AND TECHNICAL RESULTS AT MARSHAL SPACE FLIGHT CENTER Annual Report for 1983
Nov. 1983 83 p refs
(NASA-TM-82562; NAS 1.15:82562) Avail: NTIS HC A05/MF A01 CSCL 05B

Research programs in atmospheric science, materials processing in space, and space sciences as well as technology programs in space power, materials processes, and space structures are discussed. Author

N84-16076*# National Aeronautics and Space Administration, Washington, D. C.
A GUIDE TO RESEARCH IN NASA HISTORY, 7TH EDITION
Alex Roland Jan. 1984 62 p Previously announced in IAA as N82-30130
(NASA-TM-85486; NASA-HHR-50; NAS 1.15:85486) Avail: NTIS HC A04/MF A01 CSCL 05B

A guide to resources available for research in NASA history is presented. NASA Headquarters and the Washington area are emphasized, but some information is included on the NASA centers scattered across the country. A brief NASA-oriented introduction is provided. Author

N84-16077# Logistics Management Inst., Washington, D. C.
LOCAL AUTOMATION MODEL: FUNCTIONAL DESCRIPTION Report, 1 Nov. 1982
Walter P. Hamilton, III , Richard W. Hartt, and Dennis J. OConnor Sep. 1983 99 p
(Contract MDA903-81-C-0166)
(AD-A133389; AD-E950446; LMI-DL302) Avail: NTIS HC A05/MF A01 CSCL 09/2

This functional description (1) describes a system called the Local Automation Model (LAM) designed to meet the operating and service needs of a DoD technical library, and (2) lays the groundwork for subsequent development by specifying the automated processing capabilities and applications for the system. Upon review by DTIC--the system sponsor--and potential users, the functional description will provide the basis for test site implementation of the LAM and will serve as a model for other libraries in planning future implementations. GRA

N84-16078# Army Construction Engineering Research Lab., Champaign, Ill.
AN INTERACTIVE SOILS INFORMATION SYSTEM. USERS MANUAL Final Report
William D. Goran Sep. 1983 29 p
(AD-A133480; CERL-TR-N-163) Avail: NTIS HC A03/MF A01 CSCL 05/2

This report describes and provides basic instructions for using the Soils Information Retrieval System (SIRS), which was designed for efficient retrieval, analysis, and use of soils data from the U.S. Department of Agriculture's Soil Conservation Service (SCS). SIRS is an experimental subsystem of the Environmental Technical Information System which was developed by the U.S. Army Construction Engineering Research Laboratory and contains a number of computer-based information systems for use in environmental planning and management SIRS provides the user with data compiled by SCS from various soil series throughout the United States. As new information is obtained, the data is updated and inserted in SIRS. This report provides information on how to access and use SIRS, describes the type of data provided by each of the three components of SIRS, and describes the various system commands. Author (GRA)

N84-16079# Naval Research Lab., Washington, D. C.
EUROPEAN SCIENTIFIC NOTES. VOLUME 37, NUMBER 9 Monthly Progress Report, Sep. 1983
F. A. Richards, ed. and Larry E. Shaffer, ed. 30 Sep. 1983 55 p
(AD-A133558; ESN-37-9) Avail: NTIS HC A04/MF A01 CSCL 05/2

European Scientific Notes (ESN) is a monthly publication with brief articles on recent developments in European scientific research. The publication is not intended to be part of the scientific literature. The value of ESN articles to Americans is to call attention to current developments in European science and technology and to the institutions and people responsible for these efforts. ESN authors are primarily ONRL staff members. Occasionally articles are prepared by or in cooperation with the staff members of the USAF European Office of Aerospace Research and Development or the US Army Research and Standardization Group. Qualified US scientists traveling in Europe may also be invited to author an ESN article. GRA

N84-16080# SRI International Corp., Menlo Park, Calif.
RESEARCH TOPICS IN STATISTICAL DATABASE MANAGEMENT
D. Denning, W. Nicholson (Pacific Northwest Lab.), B. Sands (Statistics Canada), and A. Shoshani (California Univ., Berkeley, Lawrence Berkeley Lab.) Sep. 1983 11 p refs Presented at the 2nd Intern. Statistical Database Management Workshop, Los Altos, Calif., 27-29 Sep. 1983
(Contract DE-AC06-76RL-01830)
(DE84-002581; PNL-SA-11539; CONF-830950-3) Avail: NTIS HC A022/MF A01

Research topics in statistical data base management are identified. These topics are grouped into four major areas: characteristics of statistical data bases, functionality/usage, metadata, and logical models. DOE

N84-16081# Los Alamos Scientific Lab., N. Mex.
PROCESSING TIME USING DATATRIEVE-11, CLUNKS, AND FORTRAN
Robert R. Horning and William E. Goode (Digital Equipment Corp.) 1983 5 p refs Presented at the US Fall DECUS Symp., 24-28 Oct. 1983
(Contract W-7405-eng-36)
(DE84-001706; LA-UR-83-2979; CONF-8310182-1) Avail: NTIS HC A02/MF A01

Although Datatrieve-II processes dates with 100-ns resolution using clunks, it has no provision for processing time. A set of Datatrieve-11 procedures and FORTRAN-callable subroutines for handling time, as well as dates, expressed in clunks are described. Although the FORTRAN-callable subroutines use RMS modules, these modules can be extracted from the appropriate RMS library, allowing FORTRAN programs to be linked to an FCS library instead of to RMS. DOE

N84-16082# Science Applications, Inc., Schaumburg, Ill.
JOINT ATOMIC INFORMATION EXCHANGE GROUP INFORMATION MANAGEMENT PROJECT. BRIEFING OUTLINING FUNCTIONS AND SPECIFICATIONS OF JAIEG AUTOMATED INFORMATION MANAGEMENT SYSTEM
Marie G. Smith 20 Jul. 1983 37 p
(Contract DE-AC05-83MA-40000)
(DE84-001800; DOE/MA-40000/T3) Avail: NTIS HC A03/MF A01

The Joint Atomic Information Exchange Group (JAIEG) was formed in 1959. JAIEG's charter was to be the agent to determine the transmissibility of atomic information to foreign governments or regional defense organizations. JAIEG, operating from the joint policy direction of the Deputy Assistant Secretary for Military Application under the Department of Energy and of the Assistant to the Secretary of Defense for Atomic Energy under the Department of Defense, determines in a uniform and consistent manner the transmissibility of Restricted Data (RD) and Formerly Restricted Data (FRD). JAIEG also maintains records of all transmittal of such data, and maintains record copies of all information reviewed. This information exists only on paper and must be processed manually. JAIEG's work load has grown continuously with the size of its filing system. This has prompted an investigation of the potential benefits of automating JAIEG activities. Science Applications, Inc. (SAI) has studied JAIEG procedures and has identified several areas where JAIEG information processing activities can be automated to achieve greater system efficiency. DOE

N84-16083# Science Applications, Inc., Schaumburg, Ill.
JOINT ATOMIC INFORMATION EXCHANGE GROUP INFORMATION MANAGEMENT PROJECT. TASK 2 BRIEFING DOCUMENT. SYSTEM SPECIFICATION AND HARDWARE/SOFTWARE PURCHASE RECOMMENDATIONS FOR JAIEG AUTOMATED INFORMATION MANAGEMENT SYSTEM
Marie G. Smith and Gary M. Schwab 21 Oct. 1983 11 p
(Contract DE-AC05-83MA-40000)
(DE84-001798; DOE/MA-40000/T2) Avail: NTIS HC A02/MF A01

Several areas where JAIEG information processing activities can be automated to achieve greater system efficiency were identified. A document was written outlining the functions and specifications of an automated JAIEG information management system. This document stated that several off the shelf software development tools - a database management package, a forms management package, a word processing capability and a programming language - would greatly facilitate the implementation of the functions identified as primary candidates for computer automation. The purpose of Task 2 was to investigate the hardware and software alternatives that exist to meet the requirements developed in Task 1. A generic hardware/software specification was developed. This specification includes criteria by which existing hardware systems and software packages were evaluated. A specific system purchase recommendation was developed based on these criteria. There results are to be presented to JAIEG and TIC/DOE staff for their review in working and formal briefings. DOE

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

No abstracts in this category.

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N84-16084 California Inst. of Tech., Pasadena.
X-RAY OBSERVATIONS OF CATACLYSMIC VARIABLES Ph.D. Thesis
Kenneth A. Jensen 1983 183 p
Avail: Univ. Microfilms Order No. DA8321020

The HEAO-1 soft X-ray survey was used to derive constraints on the fraction of the total accretion luminosity which is radiated as an X-ray component from the class of undiscovered novae. These constraints show that the ratio of the ray flux to the flux from the accretion disk is much less than unity for these objects indicating that novae probably have optically thick bundary layers with temperature kT < or approximately 30 eV. Since diverse observations of recent novae, nova-like variables, and dwarf novae in outburst show that these objects also have low ratios of X-ray to accretion disk flux, the results derived for the class of undiscovered novae may be inferred to apply to these objects as well. These results suggest that the hard X-rays observed from novae, nova-like variables, and dwarf novae in outburst are produced in a region other than an equatorial boundary layer between the accretion disk and the white dwarf surface. Dissert. Abstr.

N84-16085 Colorado Univ., Boulder.
LINE PROFILE VARIABILITY IN WINDS OF OB STARS Ph.D. Thesis
Carol Anne Grady 1982 186 p
Avail: Univ. Microfilms Order No. DA8309845

Monitoring of He 2 lambda 4686 in a group of bright Of stars showed that night to night line profile variation in this transition is not limited to the Oef stars, but appears to be common in Of stars. No periodicity in the variation has been detected in any of these stars. Synthetic line profile calculations for He 2 lambda 4686, 3203, and 1640 have shown that the observed line profiles

can be reproduced for spherically symmetric, steady winds with monotonic velocity fields, only with models including hypersonic microturbulence, and regions of elevated ionization located in the He 2 line formation zone. The line profile variability can be duplicated only by varying mass flux and ionization simultaneously. UV monitoring of three O stars, delta Ori A, iota Ori A, and 15 Mon has shown that the line profile variability in these stars is non-periodic, and can be attributed to simultaneous variation in mass flux and ionization balance. Dissert. Abstr.

N84-16086 California Inst. of Tech., Pasadena.
NEAR INFRARED STUDIES OF REFLECTION NEBULAE Ph.D. Thesis
Kristen Seligren 1983 140 p
Avail: Univ. Microfilms Order No. DA8321036

Near infrared studies were made of the extended emisson from, and stellar clusters within, three visual reflection nebulae, NGC 7023, 2023, and 2068. The extended emission from each nebula consists of a smooth continuum from 1.25 to 4.8 microns which are described by a greybond with a color temperature of approximately 1000 K, and strong emission features at 3.3 and 3.4 microns. The spectrum is the same in all three sources, and is independent of position over regions 0.4 to 0.9 pc in diameter within each source. The 2.2 micron surface brightness distributions in NGC 7023 and 2023 agree well with the distributions of visual reflected light. The continuum emission cannot be explained by free-free emission, reflected light, fluorescent processes, field stars, or thermal emission from grains in equilibrium with the stellar radiation field. Dissert. Abstr.

N84-16087 California Inst. of Tech., Pasadena.
VOYAGER OBSERVATIONS OF SATURN'S RINGS. 1: THE ECCENTRIC RINGS AT 1.29, 1.45, 1.95 AND 227 Rs Ph.D. Thesis
Carolyn C. Porco 1983 165 p
Avail: Univ. Microfilms Order No. DA8321032

Five major eccentric features in the rings of Saturn are studied. These are the outer A and B ring edges at 1.95 and 2.27 R(subs) and three narrow ringlets at 1.29, 1.45, and 1.95 R(sub). Data acquired by four Voyager experiments-imaging Science (SS), Radio Science (RSS), Ultraviolet Spectrometer (UVS), and Photopolarimeter (PPS) were used in this investigation. The discovery of a periodic variation in spoke activity in Saturn's rings from the analysis of Voyager images is reported. A Fourier power spectrum was computed using a data set generated by quantifying spoke activity observed on the morning (western) half of the rings in Voyager images spanning approximately 12 Saturn rotations and in Voyager 2 images spanning approximately 90 Saturn rotations.
Dissert. Abstr.

N84-16088 Dartmouth Coll., Hanover, N.H.
PERIODIC SPECTRAL VARIATION IN CYGNUS X-2 AND SCORPIUS X-1 Ph.D. Thesis
Gerald Joseph LaSala, Jr. 1983 117 p
Avail: Univ. Microfilms Order No. DA8320823

Results of 27 nights of spectroscopic observations of Cyg X-2 during 1980 to 1981 were presented. The spectra have a resolution of 4 A and cover the spectral region 3800 to 5500 A. Typical nightly exposures were 90 minutes integration on the source; spectral classification standards were also observed. The spectra were reduced to absolute flux and binned in phase according to the 9.8 day ephemeris. The phased spectra show pronounced effects attributable to X-ray heating of the normal star, with spectral variations from A9 to F5. This supports the neutron star model as opposed to the white dwarf model. The 0.787 day binary period for Sco X-1 was reported based on radial velocity variations. The only independent confirmation of this result published to date is that of Bord, but examination of their results reveals inconsistencies which cast doubt on this confirmation. To resolve this situation new observations were conducted on 8 consecutive nights in 1982. Dissert. Abstr.

N84-16089 Rochester Univ., N. Y.
OBSERVATIONS OF THE UNIDENTIFIED 3.3 MICRONS EMISSION FEATURE IN COMPACT HII REGIONS Ph.D. Thesis
Jerry Krassner 1983 233 p
Avail: Univ. Microfilms Order No. DA8321680

Many objects have been found to exhibit broad emission features of unknown origin at several wavelengths (3.3, 7.7, 8.6, and 11.3 microns). Two theories were proposed to explain these features. One attributes the features to thermal emission from small (a < 0.01 microns) grains which can attain relatively high temperatures (T > or = 300 K) in HII regions. The other theory attributes the features to fluorescence of various molecules on grain mantles, which are excited by ultraviolet/visible photons from the hot exciting star. By combining radio and infrared observations of compact HII regions and other objects showing the 3.3 micron feature, both theories were re-examined. The observations permit the detailed physical characteristics of each object to be deduced. This is necessary to fully evaluate the plausibility of each theory for any individual nebula. As a result, the thermal emission theory is shown to be suspect on several grounds. The fluorescence model has been revised to include the situation where the fluorescing grains are in a shell of finite thickness, as indicated by the new observations. Futhermore, a major question regarding the fluorescence model, namely that the required efficiency is unfeasibly high, is re-examined and shown not to be a problem for the objects considered. Dissert. Abstr.

N84-16090 Harvard Univ., Cambridge, Mass.
OPTICAL AND X-RAY SELECTED SAMPLES OF QUASARS: EVOLUTION OF THE LUMINOSITY DISTRIBUTIONS Ph.D. Thesis
Herman Lee Marshall 1983 209 p
Avail: Univ. Microfilms Order No. DA8322408

Spectroscopic and X-ray observations obtained of quasar candidates in the 1.72 deg (2) region centered on 13 (h) 36 deg which were selected on the basis of ultraviolet excess. A complete sample totaling 35 quasars with B < 19.8 is produced. The evolution models are extrapolated to fainter magnitudes and compared with the optical number counts and independently with the observed 2 keV X-ray background. Pure density evolution models are rejected in both comparisons but LE models produce very good fits to the observed N(< B) data and predict that quasars contribute a substantial fraction to the observed X-ray background at 2 keV. These data indicate that the luminosity function is shallower at luminosities corresponding to Seyfert galaxies. The models are used to test alternatives to quasar evolution and a stellar collision theory (SCT) of mass supply. The SCT is consistent with most of the data but the predicted evolution rate is weaker than observed. Several ways of reconciling the SCT and models of the quasar emission mechanism are suggested and tested. Dissert. Abstr.

N84-16091 California Inst. of Tech., Pasadena.
PART 1: PHYSICAL STUDIES OF DISTANT COMETS. PART 2: MORPHOLOGIES OF PLANETARY NEBULAE Ph.D. Thesis
David Clifford Jewitt 1983 200 p
Avail: Univ. Microfilms Order No. DA8322672

Broadband observations of comets P/Stephan-Oterma (1980g), Bowell (1980b) and Panther (1980u) in the visual and infrared wavelength regions are reported together with measurements in the 1.5 to 2.4 microns wavelength range having 5% spectral resolution. Ice grain halos are detected around P/Stephan-Oterma and Panther. The spatial distribution of (CI)(3)P to (1)D line emission in NGC 6720 is reported. The emission emanates from small filaments in which the carbon neutral fraction may approach 10%. It is proposed that the CI is present in regions which are shielded from direct stellar photons, possibly by H2 blobs. A CCD survey of planetary nebulae reveals numerous faint halos around the primary nebulae. About 2/3 of the 44 objects observed show halos. (SII) electron density measurements show the halo mass in some nebulae. Possible origins of the halos are discussed. Dissert. Abstr.

N84-16092 Harvard Univ., Cambridge, Mass.
APERTURE SYNTHESIS OBSERVATIONS OF STAR FORMING REGIONS: COMPACT H2 REGIONS AND MASERS Ph.D. Thesis
Guido Alejandro Garay 1983 255 p
Avail: Univ. Microfilms Order No. DA8322348

Radio observations of the emission from regions of star formation due to spectral lines of hydrogen, OH and H2O and free-free continuum using Haystack, VLA and VLBI Network were made. The purpose was to provide new observations and to help to understand the early stages of star formation. The VLA radio recombination line observations of various compact HII regions towards regions of star formation were made. In addition, aperture synthesis mapping of the OH maser emission towards those regions was conducted. The OH maser spots are always projected on the face of a compact HII region. The OH masers have radial velocities which are redshifted from the associated HII region velocity. This is simply explained if the OH maser sources are part of a remnant accreting envelope which is still collapsing towards the newly formed star. Aperture synthesis observations of the Orion Nebula were made in search of compact radio sources which would help to establish which of the infrared sources in the molecular cloud might contain primary energy sources. Dissert. Abstr.

N84-16093 California Univ., Santa Cruz.
OPTICAL FLUX AND POLARIZATION SPECTRA COMPARED WITH RADIO MAPS OF RADIO GALAXIES Ph.D. Thesis
Robert Richard Joseph Antonucci 1982 203 p
Avail: Univ. Microfilms Order No. DA8323789

This project is a search for relationships between radio and optical properties of radio galaxies. A set of 6-cm radio maps was made with the VLA. Many flux and polarization spectra were taken with the Lick 3-m telescope. The most important part of the project is the identification and elucidation of geometrical alignments between optical polarization and radio source axis. The optical spectra were examined for variability. Broad permitted lines are generally highly variable, with the Balmer decrement inversely related to continuum flux. The spectra of galaxies with double radio sources were found to be systematically different from those with sources different morphologies. Similarly it was found that the emission-line spectra of optical N systems are different from those of optical E types. Variations in optical polarization amount and position angle appear to be common, and they are not simply related to flux changes. Dissert. Abstr.

N84-16094# Institute of Space and Astronautical Science, Tokyo (Japan).
FINE POINTING CONTROL OF THE SOLAR UV TELESCOPE ON THE SOUNDING ROCKET S-520-5
Ichiro Nakatani, Tadanao Sato, Toshizumi Tange, Shigeo Hamana (Tokyo Univ.), Tadashi Hirayama (Tokyo Univ.), Keizo Nishi (Tokyo Univ.), and Kyo Akita (Tokyo Univ.) Nov. 1983 14 p refs
(ISAS-608; ISSN-0285-6808) Avail: NTIS HC A02/MF A01

The performance of the attitude control system of a sounding rocket (S-520-5) and the fine pointing system incorporated in a solar ultraviolet telescope is described. The achieved pointing accuracy was within + or - .03 degree for the attitude control of the body, and within + or .5 second of arc in the fine pointing for about half of the observing time. Author

N84-16095*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
A MERCURIC DETECTOR SYSTEM FOR X-RAY ASTRONOMY. 2. RESULTS FROM FLIGHT TESTS OF A BALLOON BORNE INSTRUMENT
J. V. Vallegra, R. K. Vanderspek, and G. R. Ricker [1982] 30 p refs
(Grants NsG-7339; NAGw-14)
(NASA-CR-175329; NAS 1.26:175329) Avail: NTIS HC A03/MF A01 CSCL 03A

To establish the expected sensitivity of a new hard X-ray telescope design, an experiment was conducted to measure the background counting rate at balloon altitudes (40 km) of mercuric iodide, a room temperature solid state X-ray detector. The prototype detector consisted of two thin mercuric iodide (HgI2) detectors surrounded by a large bismuth germanate (Bi4Ge3O12) scintillator operated in anticoincidence. The bismuth germanate shield vetoed most of the background counting rate induced by atmospheric gamma-rays, neutrons and cosmic rays. A balloon-borne gondola containing a prototype detector assembly was designed, constructed and flown twice in the spring of 1982 from Palestine, Texas. The second flight of this instrument established a differential background counting rate of 4.2 O.7 x 10-5 counts/sec cm keV over the energy range of 40 to 80 keV. This measurement was within 50% of the predicted value. The measured rate is approx 5 times lower than previously achieved in shielded NaI/CsI or Ge systems operating in the same energy range. The prediction was based on a Monte Carlo simulation of the detector assembly in the radiation environment at float altitude. Author

N84-16096*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
DEVELOPMENT OF A MERCURIC IODIDE SOLID STATE SPECTROMETER FOR X-RAY ASTRONOMY Final Report
John B. Vallerga Sep. 1983 139 p refs
(Grant NAGw-14)
(NASA-CR-175330; NAS 1.26:175330) Avail: NTIS HC A07/MF A01 CSCL 03A

Mercuric iodide detectors, experimental development for astronomical use, X ray observations of the 1980 Cygnus X-1 High State, astronomical had X ray detectors in current use, detector development, balloon flight of large area (1500 sq cm) Phoswich detectors, had X ray telescope design, shielded mercuric iodide background measurement, Monte Carlo analysis, measurements with a shielded mercuric iodide detector are discussed. Author

N84-16097*# Essex Corp., Huntsville, Ala.
SPACE TELESCOPE Final Report
Edwin C. Pruett, Kem B. Robertson, Charles N. VanValkenburg, and Wayne Reed 13 Sep. 1983 34 p
(Contract NAS8-33272)
(NASA-CR-170948; NAS 1.26:170948; H-83-06) Avail: NTIS HC A03/MF A01 CSCL 03A

Space telescope drawings, mockup drawings, space support equipment, and Spacelab experiment hardware are discussed. N.W.

N84-16098# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
INFRARED MEASUREMENTS OF AFGL (AIR FORCE GEOPHYSICS LABORATORY) SOURCES Final Report, Mar. 1980 - Sep. 1983
R. D. Gehrz, J. A. Hackwell, and Gary L. Grasdalen Hanscom AFB, Mass. AFGL 7 Jun. 1983 132 p
(Contract F19628-80-C-0076; AF Proj. 7670)
(AD-A133553; AFGL-TR-83-0099) Avail: NTIS HC A07/MF A01 CSCL 03/1

We report infrared positions and multicolor infrared photometry for a sample of type II OH/IR stars. The infrared colors and 11.4 micrometer silicate optical depths of the low-latitude sources in this group increase as a function of distance, suggesting that interstellar reddening must be taken into account in assessing their infrared energy distributions. Redding gradients between 1 and 3 times higher than the mean gradient in the direction of the galactic center are required to account for the observed color-distance correlation, a fact which might be explained by these stars' confinement to spiral arms. The noise limited magnitudes for the AFGL Infrared Sky Survey have been estimated by direct comparison with ground based observations. Using these limiting magnitudes pruned versions of teh AFGL catalog have been generated. Infrared observations of all the stellar objects seen at 11, 20 or 27 micrometers and a statistical sample of the stars seen only at 4 micrometers are reported. Analysis of the observations leads to estimates of the absolute 4 and 10 micrometers magnitudes and space densities for the two classes of objects.

The expected results from the Infrared Astronomical Satellite are re-examined. Author (GRA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N84-16099 Illinois Univ., Urbana-Champaign.
AMBIPOLAR DIFFUSION IN INTERSTELLAR CLOUDS: ONE-DIMENSIONAL, ISOTHERMAL COLLAPSE Ph.D. Thesis
Efthimios Paleologou 1983 94 p
Avail: Univ. Microfilms Order No. DA8324616

The formulation of a theory of star formation faces two fundamental problems: (1) the angular momentum problem and (2) the magnetic flux problem. It has been previously demonstrated by detailed calculations that magnetic braking by itself can resolve the angular momentum problem (at least for binary stars and, most likely, for single stars as well) during the early, relatively diffuse stages of cloud contraction. The magnetic flux problem lies in the observation that fluxes of typical stars are between 2 and 5 orders of magnitude smaller than fluxes of corresponding masses at interstellar densities. The detailed calculations of collapsing model clouds described in this paper show that the flux-to-mass ratio in cloud cores can decrease by more than 4 orders of magnitude at neutral densities n sub n< 10 to the 9th power/cu cm due to ambipolar diffusion alone. Ambipolar diffusion sets in at gas densities larger than those by which the bulk of the angular momentum problem is resolved by magnetic braking. Dissert. Abstr.

N84-16100 California Univ., Santa Cruz.
LOW-IONIZATION EMISSION REGIONS IN THE NUCLEI OF SPIRAL GALAXIES Ph.D. Thesis
William Clifford Keel 1982 210 p
Avail: Univ. Microfilms Order No. DA8323467

New spectrophotometry and narrow-band digital images have been obtained for bright spiral galaxies with low-ionization emission regions in their nuclei. These regions are characterized by strong forbidden lines from neutral or once-ionized species, with relatively weak Balmer emission. A survey of H alpha and [n II] lambda 6584 emission in a complete sample of 93 spirals shows emission in all nuclei, with low-ionization emission seen in 85% of galaxies of types SO/a through Sbc. For a given stellar continuum luminosity, emission regions excited by stellar photoionization (H II regions) are more luminous than low-ionization regions; H II regions may mark or replace existing low-ionization regions when bursts of star formation occur. The narrow-band images have been processed to yield pure H alpha + [n II] images. These show that the optically emitting gas in low-ionization spiral nuclei is usually concentrated in a nearly spherical core of half-intensity diameter typically 200 pc, often surrounded by a disk, in the galactic plane, traceable over a 600-900 pc diameter. Dissert. Abstr.

N84-16101 Illinois Univ., Urbana-Champaign.
THE INTERSTELLAR MEDIUM ALONG THE LINE OF SIGHT TOWARD X PER Ph.D. Thesis
David Jeffrey Lien 1983 289 p
Avail: Univ. Microfilms Order No. DA8324595

Ultraviolet, optical, and radio observations of the Bc V star X Per were used to analysis the physical conditions within the obscuring diffuse cloud. The ultraviolet Explorer satellite. The optical data are primarily blue echelle spectra. The radio data are C12O and C13OJ = 1 to 0 emission lines. More than 200 atomic and molecular UV absorption lines were observed, and previously unobserved transitions from Si 1, S 1, C 2, Fe 2, Ge 2, and Ga 2. The O to O bond of the F to X electronic system of C(2) was detected. A kinetic temperature of 40 K was derived from a line profile analysis of this system. The electron density is 0.02 1/cu cm. The hydrogen density ranges from 100 1/cu cm to 1000 1/cu cm, depending on the method used. Dissert. Abstr.

N84-16102# California Univ., Livermore. Lawrence Livermore Lab.
PROBLEMS IN ASTROPHYSICAL RADIATION HYDRODYNAMICS
John I. Castor 14 Sep. 1983 44 p refs Presented at the NATO Workshop on Astrophys. Radiation Hydrodyn., Munich, Jul. 1982 Submitted for publication
(Contract W-7405-eng-48)
(DE84-000185; UCRL-89811; CONF-8207100-1) Avail: NTIS HC A03/MF A01

The basic equations of radiation hydrodynamics are discussed in the regime that the radiation is dynamically as well as thermally important. Particular attention is paid to the question of what constitutes an acceptable approximate non-relativistic system of dynamical equations for matter and radiation in this regime. Further discussion is devoted to two classes of application of these ideas. The first class consists of problems dominated by line radiation, which is sensitive to the velocity field through the Doppler effect. The second class is of problems in which the advection of radiation by moving matter dominates radiation diffusion. DOE

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N84-16103 Harvard Univ., Cambridge, Mass.
SOME ISSUES RELATED TO EVOLUTION OF PLANETARY ATMOSPHERES Ph.D. Thesis
John H. Yatteau 1983 280 p
Avail: Univ. Microfilms Order No. DA8322472

This work considers several issues related to atmospheric evolution on Venus and Earth. Chapter 1 introduces 5 topics related to atmospheric evolution on Venus which will be specifically addressed in remaining chapters: (1) photochemical stability of CO2, (2) abundance and distribution of water, (3) abundance of CO and oxidation state of the atmosphere, (4) hydrogen escape and its effect on composition, and (5) deuterium enrichment. Chapter 2 considers the response of the hydrogen escape flux on Venus to changes in composition, effusion velocity, and temperature. Chapter 3 establishes the observational, thermodynamic, and photochemical constraints on the abundance of molecular hydrogen above the clouds of Venus. Chapter 4 extends the work of Yung and DeMore (1982) on the photochemical stability of CO2, employing more realistic models for sulphur and water supply to the stratophere. Chapter 5 considers the evolutionary implications of recent work on specific nonthermal escape mechanisms using results from earlier chapters to constrain evolutionary models. Chapter 6 is a separate investigation of the evolution of noble gases on Earth. Dissert. Abstr.

N84-16104 Harvard Univ., Cambridge, Mass.
TRANSPORT PROCESSES IN PLANETARY ATMOSPHERES Ph.D. Thesis
Jose Manuel Rodriguez 1983 331 p
Avail: Univ. Microfilms Order No. DA8322432

Transport processes in the upper atmospheres of Earth and Venus are considered. An efficient method for calculating photoelectron fluxes on Earth along a magnetic field line, as a function of energy and pitch angle is presented. Transport effects are included, as well as all relevant photoionization and collisional processes. Arbitrary angular dependence in the differential cross sections is incorporated. Calculated fluxes agree with experimental measurements on the Atmospheric Explorer satellites. Transport effects become noticeable at 400 km. Considerable fluxes are transported to the conjugate point along magnetic field lines if the forward-packed differential cross sections for electron scattering is included. Sources of energetic oxygen and hydrogen atoms on

Venus are examined in light of data from Pioneer Venus.
Dissert. Abstr.

N84-16105# Los Alamos Scientific Lab., N. Mex. Space Plasma Physics Div.
ENERGY DISTRIBUTIONS AND YIELDS OF SECONDARY IONS AND ELECTRONS EMITTED BY GIOTTO DURING HALLEY ENCOUNTER
D. T. Young 1983 9 p refs Presented at the 17th ESLAB Symp. on Spacecraft-Plasma Interactions and their Influence on Field and Particle Meas., Novrdwijk (Netherlands), 1 Sep. 1983 (Contract W-7405-eng-36)
(DE84-001661; LA-UR-83-2887; CONF-8309176-1) Avail: NTIS HC A02/MF A01

The extreme ram velocity of the GIOTTO space-craft with respect to the Halley environment will produce a host of surface impact phenomena not previously encountered by planetary spacecraft. This paper extends earlier efforts to model impact produced plasma at GIOTTO by investigating published data on secondary electron and ion energy distributions, including the effect of possible surface contamination. One new result is the finding that the threshold velocity for kinetic emission of secondary electrons by neutral gas is very nearly equal to the GIOTTO ram velocity. This makes it difficult to predict electron yields due to neutral gas impact. DOE

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N84-16106 California Univ., Los Angeles.
THE HARMONIC STRUCTURE OF PC 3-4 MAGNETIC PULSATIONS AT GEOSYNCHRONOUS ORBIT AND ITS RELATION TO THE SOLAR WIND Ph.D. Thesis
Kazue Takahashi 1983 218 p
Avail: Univ. Microfilms Order No. DA8322037

Observations of magnetic Pc 3-4 pulsations (7-100 mHz) at geosynchronous orbit are presented. It is found that Pc 3-4 pulsations are generally produced by a superposition of harmonics of the fundamental oscillation of geomagnetic field lines. In addition, it is demonstrated that parameters in the solar wind control the occurrence and the power spectrum of Pc 3-4 pulsations. These observations are discussed in relation to possible sources of wave energy near the interface of the magnetosphere with the solar wind. Dynamic spectra for the azimuthal component of the magnetic field observed by the geosynchronous satellite ATS 6 are characterized by several discrete traces constituting a harmonic series. The amplitude of the harmonics depends on magnetic latitude but the frequency does not. These properties are consistent with standing Alfven waves excited at multiple harmonics of the fundamental oscillation. A detailed comparison between satellite observation and numerical calculations on the properties of standing Alfven waves is presented. Dissert. Abstr.

N84-16107*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DECIMETRIC GYROSYNCHROTRON EMISSION DURING A SOLAR FLARE
David A. Batchelor (North Carolina Univ.), Arnold O. Benz (Inst. of Astronomy), and Herbert J. Wiehl (Berne Univ.) Nov. 1983 32 p refs Submitted for publication
(NASA-TM-85123; NAS 1.15:85123; REPT-684) Avail: NTIS HC A03/MF A01 CSCL 03B

A decimetric, microwave, and hard X-ray burst was observed during a solar flare in which the radio spectrum below peak flux fits an f+2 power law over more than a decade in frequency. The spectrum is interpreted to mean that the radio emission originated in a homogeneous, thermal, gyrosynchrotron source. This is the first time that gyrosynchrotron radiation has been identified at such low decimetric frequencies (900-998) MHz). The radio emission was cotemporal with the largest single hard X-ray spike burst ever reported. The spectrum of the hard X-ray burst can be well represented by a thermal bremsstrahlung function over the energy range from 30 to 463 keV at the time of maximum flux. The temporal coincidence and thermal form of both the X-ray and radio spectra suggest a common source electron distribution. The unusual low-frequency extent of the single-temperature thermal radio spectrum and its association with the hard X-ray burst imply that the source had an area approx. 10(18) sq cm a temperature approx 5x10(8) K, an electron density < approx. 7.10(9) cu cm and a magnetic field of approx. 120 G. H(alpha) and 400-800 MHz evidence suggest that a loop structure of length 10,000 km existed in the flare active region which could have been the common, thermal source of the observed impulsive emissions.
Author

N84-16108*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TURBULENT HEATING IN SOLAR COSMIC RAY THEORY
James Weatherall (NAS-NRC) Jul. 1983 24 p refs Submitted for publication
(NASA-85074; NAS 1.15:85074) Avail: NTIS HC A02/MF A01 CSCL 03B

The heating of minor ions in solar flares by wave-wave-particle interaction with Langmuir waves, or ion acoustic waves, can be described by a diffusion equation in velocity-space for the particle distribution function. The dependence of the heating on the ion charge and mass, and on the composition of the plasma, is examined in detail. It is found that the heating mechanisms proposed by Ibragimov and Kocharov cannot account for the enhanced abundances of heavy elements in the solar cosmic rays. Author

N84-16109# Tufts Univ., Medford, Mass. Dept. of Physics.
VERY LARGE ARRAY OBSERVATIONS OF SOLAR ACTIVE REGIONS. 4: STRUCTURE AND EVOLUTION OF RADIO BURSTS FROM 20 cm LOOPS Interim Report
Robert F. Willson and Kenneth R. Lang Jul. 1983 30 p
(Grant AF-AFOSR-0019-83; AF Proj. 2311)
(AD-A133907; AFOSR-83-0843TR) Avail: NTIS HC A03/MF A01 CSCL 03/2

The Very Large Array (VLA) has been used to study the structure and evolution of six solar bursts near 20 cm wavelength. In most cases the burst emission has been resolved into looplike structures with total lengths, approx, 3 x 10 to the minus 9th power cm, brightness temperatures approx. 10 to the 7th to 8th power K and degress of circular polarization approx. or 90%. Changes in the total intensity and circular polarization of the bursts occur on timescales as short as ten seconds. The individual peaks of one multiple component burst originated in different locations within a magnetically complicated region. Preburst heating and circular polarization changes respectively occurred minutes before the onset of the impulsive phase of two bursts. In one case a loop system emerged in the vicinity of the impulsive source, and two adjacent loop systems may have emerged and triggered the burst. GRA

N84-16110# Tufts Univ., Medford, Mass. Dept. of Physics.
THE CIRCULARLY POLARIZED SUN AT 12.6 cm WAVELENGTH Interim Report
Kenneth R. Lang and Robert F. Willson Jun. 1983 15 p
(Grant AF-AFOSR-0019-83; AF Proj. 2311)
(AD-A133668; AFOSR-83-0848TR) Avail: NTIS HC A02/MF A01 CSCL 03/2

Circular polarization maps of the Sun with 45 sec angular resolution at 12 cm wavelength are presented for six continuous days. The maps have degrees of circular polarization up to pc = 20%, and they show an excellent correlation with photostatic magnetograms. A similar correlation exists at 6 cm and 20 cm, and at all three wavelentghs the brightness temperatures, TB, of the circularly polarized emission is TB approx 1,000,000 K. This suggests that the emission at all three wavelengths is due to the same hot plasma radiating in the presence of magnetic fields that

project radially upwards from the photosphere into the low solar corona. At 6 cm wavelength highly circularly polarized (pc appprox 50%), core sources with angular sizes 0 approx 10 sec to 30 sec occur near sunspots. These core sources are due to gyroesonant emission at the third harmonic of the gyrofrequency, implying longitudinal magnetic field strengths of HI approx 580 spots, gauss at altitudes h approx 3 x 10 to the ninth power cm above the sunspots. In regions near sunspots, the circularly polarized emission at 6 cm, 12 cm and 20 cm could all be due to the gyroemission of hot electrons spiralling in magnetic fields of strength HI approx 280 gauss and HI approc 170 guass are inferred from the 12 cm and 20 cm data, respectively. An alternative explanations is polarization by bremsstrahlung propagating in magnetic fields of strength HI approx 100 guass and 50 gauss, respectively. GRA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N84-16111 Pennsylvania Univ., Philadelphia.
ELECTROMAGNETIC, GRAVITATIONAL, AND NEUTRINO WAVES IN FLAT AND CURVED SPACETIME Ph.D. Thesis
Kay Rhoda Pechenick 1983 203 p
Avail: Univ. Microfilms Order No. DA8316072

Radiation in strong gravitational fields is discussed. Various problems are treated, including (1) cosmological neutrinos, (2) gravitational and electromagnetic waves near rotating black holes, and electromagnetic waves from (3) pulsating stars and (4) rotating stars. Inverse scattering is considered; i.e., from the scattered wave one determines the potential. Here the potential corresponds to the ionospheric electron density, and the waves are electromagnetic. Dissert. Abstr.

N84-16112*# California Univ., Berkeley.
STUDIES OF HIGHLY VARIABLE GALACTIC X-RAY SOURCES WITH HEAO-1 Final Technical Report
Lynn Cominsky 31 Oct. 1983 2 p
(Contract NAG8-446)
(NASA-CR-170941; NAS 1.26:170941) Avail: NTIS HC A02/MF A01 CSCL 03B

Analysis HEAO-AI data on MXB1659-29 revealed a 7.1 hour period from this X-ray burst source. The erratic dips seen in both SAS-3 and HEAO-AI data were concentrated within 1.5 hours (about 25%) of the orbital cycle. There appeared to be a stable dip at the end of the 1.5 h of erratic varibility. It was established that the stable dip was a true eclipse of the central X-ray emitting object. MXB1659-29 is the first X-ray burster to show eclipses and a precise orbital clock. A.R.H

N84-16113# Naval Research Lab., Washington, D. C.
CALCULATION OF COSMIC RAY INDUCED SINGLE EVENT UPSETS: PROGRAM CRUP (COSMIC RAY UPSET PROGRAM)
P. Shapiro 14 Sep. 1983 41 p
(AD-A133620; NRL-MR-5171) Avail: NTIS HC A03/MF A01 CSCL 03/2

This report documents PROGRAM CRUP, COSMIC RAY UPSET PROGRAM. The computer program calculates cosmic ray induced single-event error rates in microelectronic circuits exposed to several representative cosmic-ray environments. Author (GRA)

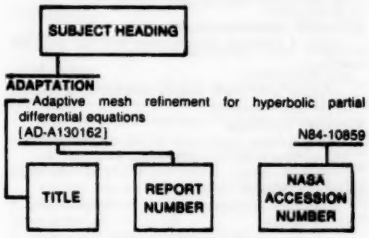
N84-16114# Arizona State Univ., Tempe. Dept. of Physics.
THEORETICAL CALCULATION OF RAPID X-RAY TRANSIENTS AND RADIUS EXPANSION
Sumner Starrfield, Warren Sparks (Los Alamos National Lab.), James Truran (Illinois Univ., Urbana), and Scott Kenyon (Illinois Univ., Urbana) 1983 4 p refs Presented at the Workshop on High Energy Transients, Santa Cruz, Calif., 11 Jul. 1983
(Contract W-7405-eng-36)
(DE84-001312; LA-UR-83-2744; CONF-830797-2) Avail: NTIS HC A02/MF A01

A calculation of a thermonuclear runaway on a 10 km neutron star which produces two X-ray bursts separated by approx. 2500 sec. DOE

99 GENERAL

No abstracts in this category.

Typical Subject Index Listing



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A

ABERRATION
Technical support for AXAF
[NASA-CR-170950] N84-15959

ABILITIES
Performance appraisal revisited
[AD-A132841] N84-16059

ABRASION RESISTANCE
Abrasion-erosion resistance of concrete made with two aggregates, Stonewall Jackson Dam, West Virginia
[AD-A133432] N84-15357

ABRASIVES
New profilable bond system for diamond and CBN grinding wheels
[CSIR-TRANS-1707] N84-15294

ABSORPTION
Variation of laser absorption with plasma scalelength in long-scalelength plasmas
[DE84-002743] N84-15991

ABSORPTION COOLING
A general computer model for predicting the performance of gas sorption refrigerators N84-15349
LaNi5 hydride cryogenic refrigerator test results N84-15350

ABSORPTION CROSS SECTIONS
Process for isotope separation
[DE84-001983] N84-15507

ABSORPTION SPECTRA
EXAFS studies of the metallic glass La80Ga20
[DE84-002022] N84-15278
Process for isotope separation
[DE84-001983] N84-15507

ABSORPTIVITY
High precision material study at near millimeter wavelengths
[AD-A133575] N84-15966

ACCELERATED LIFE TESTS
Research in some applied, and the modelling aspects of, reliability theory
[AD-A133424] N84-15567

ACCELERATION (PHYSICS)
An alternative method of analysis for base accelerated dynamic response in NASTRAN N84-15598
Perception of higher derivatives of visual motion
[AD-A133908] N84-15773
Fast asynchronous level 1 pre-trigger for electrons at L = 10/sup 33 cm-2 sec-1 N84-15933

ACCIDENT INVESTIGATION
Practical approaches in accident analysis --- unconfined gas explosions N84-15441

ACCIDENTS
Studies on sodium boiling phenomena in out of pile rod bundles for various accidental situations in Liquid Metal Fast Breeder Reactors (LMFBR) experiments and interpretations N84-15493

ACCLIMATIZATION
Increased metabolism and dead space as components of ventilation at high altitude
[AD-A130627] N84-15766

ACCUMULATORS
Performance of computer-designed small-size multistage depressed collectors for a high-perveance traveling wave tube
[NASA-TP-2248] N84-15394

ACCURACY
A comparison of NMC models (1977) on precipitation forecasts for east coast cyclogenesis N84-15720
Pacific Northwest solar radiation data
[DE84-002335] N84-15738
A FMCW radar ranging device for the teleoperator maneuvering system N84-16045

ACETYLENE
Diode laser spectrophotometry for monitoring acetylene on-line in a liquefaction plant
[DE84-002117] N84-15548

ACID RAIN
Simulated precipitation reference materials, 4
[PB83-139378] N84-15742

ACIDITY
Simulated precipitation reference materials, 4
[PB83-139378] N84-15742

ACOUSTIC ATTENUATION
Marine environmental acoustics
[AD-A133245] N84-15902

ACOUSTIC EMISSION
Shock associated noise --- nozzles N84-15030
Aspects of damping of sonic vibrations due to impact loading in plate steels
[BLL-M-35295-(5828.4)] N84-15895
A review of underwater acoustic systems and methods for locating objects lost at sea
[NASA-TM-85727] N84-15898

ACOUSTIC EXCITATION
The effects of acoustic excitation on the mixing of two parallel laminar streams of fluid
[AD-A126788] N84-15502

ACOUSTIC IMPEDANCE
Acoustic diffraction by an impedance-covered edge
[AD-A133266] N84-15904

ACOUSTIC MEASUREMENT
Aerodynamic sources of acoustic radiation from a single MOD-2 wind turbine
[DE84-000013] N84-15905

ACOUSTIC PROPAGATION
A review of source location/assessment techniques --- aeroacoustics N84-15029
Acoustical modes of arbitrary volumes using NASTRAN transient heat transfer RF9 N84-15597

ACOUSTIC SCATTERING
Acoustic diffraction by an impedance-covered edge
[AD-A133266] N84-15904

ACOUSTICS
Nonlinear acoustics instabilities in combustion chambers N84-15230

ACRYLATES
Synthesis and characterization of some thermotropic nematic and cholesteric polymers N84-15262

ACTIVATION ENERGY
A review of theories currently being used to model steady plane flames on flame-holders
[CA-8316] N84-15218

ACTIVE CONTROL
ACOSS Fourteen (Active Control of Space Structures)
[AD-A133411] N84-15181

ACTUATORS
A study of digitally controlled flight control actuation
[AD-A133274] N84-15160

ADAPTATION
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371

ADAPTIVE CONTROL
Direct multivariable model reference adaptive control with applications to large structural systems N84-15840

ADAPTIVE FILTERS
Adaptive protection of detecion systems operating by spread spectrum N84-15852

ADDITIVES
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246

ADHESIVES
Nonlinear viscoelastic characterization of structural adhesives
[NASA-CR-172279] N84-15268
Hot melt recharge system --- space maintenance
[NASA-CASE-LAR-12881-2] N84-15271

ADIABATIC CONDITIONS
A study of accretion in compact sources: Disk precession and jet helicity N84-16038

ADIABATIC DEMAGNETIZATION COOLING
Design of an adiabatic demagnetization refrigerator for studies in astrophysics N84-15352

ADSORPTION
Optimal design of gas adsorption refrigerators for cryogenic cooling N84-15348

ADVECTION
Growth processes of snow
[AD-A133136] N84-15639
The advection of submesoscale thermal features in the Alboran Sea Gyre
[AD-A133877] N84-15749

AERIAL PHOTOGRAPHY
Image understanding research and its application to cartography and computer-based analysis of aerial imagery
[AD-A133495] N84-15642

AERIAL RECONNAISSANCE
Uranium anomalies in Wyoming and parts of adjacent states. National Uranium Resource Evaluation
[DE83-005353] N84-15638

AERIAL RUDDERS
Determination of elevator and rudder hinge forces on the Learjet model 55 aircraft N84-15604

AEROACOUSTICS
Aeroacoustics: Ten Years of Research --- conferences
[VKI-LS-1983-05] N84-15025
Helicopter noise N84-15027
A review of source location/assessment techniques --- aeroacoustics N84-15029
Generation of sound in turbulent shear flows N84-15031
Instrumentation and signal analysis --- aeroacoustics N84-15032
Mach 0.6 to 3.0 flows over rectangular cavities
[AD-A134579] N84-15121

AERODYNAMIC CHARACTERISTICS
A study of helicopter rotor aerodynamics in ground-effect at low speeds N84-15106
Aerodynamics, aeroelasticity, and stability of hang gliders N84-15134

AERODYNAMIC CONFIGURATIONS
Optimization of waverider configurations generated from non-axisymmetric flows past a nearly circular cone N84-15108

Computational procedures in transonic aerodynamic design
[NLR-MP-82020-U] N84-15131

AERODYNAMIC FORCES
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169
Determination of elevator and rudder hinge forces on the Learjet model 55 aircraft N84-15604

AERODYNAMIC LOADS
Loads and aeroelasticity division research and technology accomplishments for FY 1982 and plans for FY 1983
[NASA-TM-84594] N84-15120
The effect of superposing ripple loading of maneuver load cycles
[AD-A132653] N84-15148
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169

AERODYNAMIC STALLING
Pilot human factors in stall/spin accidents of supersonic fighter aircraft N84-15102

AERODYNAMICS
Aerodynamic sources of acoustic radiation from a single MOD-2 wind turbine
[DE84-000013] N84-15905

AEROELASTICITY
Loads and aeroelasticity division research and technology accomplishments for FY 1982 and plans for FY 1983
[NASA-TM-84594] N84-15120
Aerodynamics, aeroelasticity, and stability of hang gliders N84-15134
Bladed-shrouded-disc aeroelastic analyses: Computer program updates in NASTRAN level 17.7
[NASA-CR-165428] N84-15154
Aeroelastic analysis of a Darrieus type wind turbine blade with troposkien geometry N84-15623

AERONAUTICS
Design, development and flight test of a demonstration advanced avionics system N84-15067
Fuel economy in aviation
[NASA-SP-462] N84-15144

AEROSOLS
Satellite measurements of marine aerosols N84-15671
Status of research in progress at the Inhalation Toxicology Research Institute
[DE83-012610] N84-15694
Radiative-dynamic properties of Arctic stratus clouds and their possible modification by aerosol particles
[DFVLR-FB-83-23] N84-15740
Exposure chamber for studies of pollutant gases and aerosols in human subjects: Design considerations
[DE84-001135] N84-15785
Determination of particle-size distribution by measuring the transmission of an aerosol in sedimentation
[AD-A133288] N84-15962
Jet-impact nebulization for sample introduction in inductively coupled plasma spectrometry
[AD-A133152] N84-15982

AEROSPACE ENGINEERING
Detroit space odessey
[NASA-TM-85487] N84-15164
Cleveland Space Odyssey
[NASA-TM-85493] N84-16020
A guide to research in NASA history, 7th edition
[NASA-TM-85486] N84-16076

AEROSPACE MEDICINE
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 252)
[NASA-SP-7011(252)] N84-15763

AEROSPACE SAFETY
Software testing of safety critical systems N84-15073

AEROTHERMODYNAMICS
Loads and aeroelasticity division research and technology accomplishments for FY 1982 and plans for FY 1983
[NASA-TM-84594] N84-15120
Aerothermal modeling, phase 1. Volume 1: Model assessment
[NASA-CR-168296-VOL-1] N84-15155
Aerothermal modeling, phase 1. Volume 2: Experimental data
[NASA-CR-168296-VOL-2] N84-15156
Aerothermodynamics of Low Pressure Steam Turbines and Condensers, volume 1 — conferences
[VKI-LS-1983-06-VOL-1] N84-15472
The design of modern Low Pressure (LP) steam turbines N84-15473
Turbine aerodynamic design using through-flow theory. Meridional through-flow calculation N84-15474
Aerodynamics and steam wetness fraction of a multistage turbine. Comparison of prediction with experimental data N84-15475
Applications of through-flow theory — steam turbines N84-15477
Trends in steam turbine design, testing and manufacturing N84-15478
A method of calculating fully three dimensional inviscid flow through any type of turbomachine blade row N84-15479
A review of current research activity on the aerodynamics of axial flow turbines N84-15480
Three-dimensional flow calculations on a hypothetical steam turbine last stage N84-15481
Aerothermodynamics of Low Pressure Steam Turbines and Condensers, Volume 2 — conferences
[VKI-LS-1983-06-VOL-2] N84-15482
Steam condenser thermal design theories N84-15485

AGRICULTURE
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15651

AIR DEFENSE
Tactical requirements impact on avionics/weapon system design N84-15036
Improved dynamic models for air combat analysis
[TAE-483] N84-15876

AIR FLOW
A study of helicopter rotor aerodynamics in ground-effect at low speeds N84-15106
Evaluation of air-cooled central receivers
[DE83-005130] N84-15423

AIR NAVIGATION
Methods for developing the navigation and weapon systems of the Mirage 2000 N84-15068

AIR POLLUTION
Exposure chamber for studies of pollutant gases and aerosols in human subjects: Design considerations
[DE84-001135] N84-15785

AIR QUALITY
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777

AIR TRAFFIC CONTROL
Establishment and discontinuance criteria for airport traffic control towers
[AD-A133461] N84-15141
Video processor for air traffic control beacon system
[NASA-CASE-KSC-11155-1] N84-15395

AIR TRAFFIC CONTROLLERS (PERSONNEL)
Color perception and ATC job performance
[AD-A132649] N84-15781
Computer based landing signal officer carrier aircraft recovery model
[AD-A133507] N84-15808

AIR WATER INTERACTIONS
Climate-chemistry connection
[DE84-001950] N84-15739

AIRBORNE EQUIPMENT
Critical factors and operational research in tactical fighter avionic system development N84-15062
A study on airborne integrated display system and human information processing
[NASA-TM-77338] N84-15789

AIRBORNE/SPACEBORNE COMPUTERS
CASCADE: A design environment for future avionic systems N84-15057
Methods for developing the navigation and weapon systems of the Mirage 2000 N84-15068
The man-machine interface in new generation commercial aircraft N84-15096

AIRCRAFT ACCIDENT INVESTIGATION
Investigation, reporting and analysis of US Army aircraft accident N84-15077
The use of flight recorders in the investigation of aircraft mishaps N84-15078

AIRCRAFT ACCIDENTS
Flight Mechanics and System Design Lessons From Operational Experience
[AGARD-CP-347] N84-15076
Investigation, reporting and analysis of US Army aircraft accident N84-15077
The use of flight recorders in the investigation of aircraft mishaps N84-15078
Two decades of air carrier jet operation N84-15080
Worldwide experience of wind shear during 1981-1982 N84-15087
Some comments on the hazards associated with manoeuvring flight in severe turbulence at high speed and low altitude N84-15089
Army helicopter crashworthiness N84-15090
Linguistic methodology for the analysis of aviation accidents
[NASA-CR-3741] N84-15135
Airborne lightning characterization
[AD-A130627] N84-15733

AIRCRAFT CARRIERS
Computer based landing signal officer carrier aircraft recovery model
[AD-A133507] N84-15808

AIRCRAFT COMPARTMENTS
Inhalation toxicology. 3: Evaluation of thermal degradation products from aircraft and automobile engine oils, aircraft hydraulic fluid, and mineral oil
[AD-A133221] N84-15778

AIRCRAFT CONFIGURATIONS
TAS: A Transonic Aircraft/Store flow field prediction code
[NASA-CR-3721] N84-15114
Analysis of nonplanar wing-tip mounted lifting surfaces on low-speed airpianes N84-15142

AIRCRAFT CONTROL
Flying qualities experiments of rate command/attitude hold systems in the HFB 320 in-flight simulator
[DFVLR-FB-83-25] N84-15163

AIRCRAFT DESIGN
Operational readiness and its impact on fighter avionics system design N84-15037
Increasing significance of electromagnetic effects in modern aircraft development N84-15041
Computational procedures in transonic aerodynamic design
[NLR-MP-82020-U] N84-15131

AIRCRAFT DETECTION
Distributed sensor network
[AD-A133250] N84-15903

AIRCRAFT ENGINES
Aerothermal modeling. Executive summary
[NASA-CR-168330] N84-15152
Broad specification fuels combustion technology program
[NASA-CR-168179] N84-15283

AIRCRAFT EQUIPMENT
DEF STAN 00-18: A family of compatible digital interface standards N84-15049
A video bus for weapon system integration N84-15051
Network communications for a distributed avionics system N84-15052
Avionics fault tree analyzer N84-15053
Computer graphics techniques for aircraft EMC analysis and design N84-15055
The lock-on-before-launch weapon delivery and display/control consideration N84-15056
A practical approach to the design of a new avionic system N84-15058
Integration of ICNIA into advanced high performance fighter aircraft N84-15059
Methods for developing the navigation and weapon systems of the Mirage 2000 N84-15068
Concepts for avionic and weapon integration facilities N84-15070
Advanced high-power generator for airborne applications
[AD-A133290] N84-15398
Far Infrared Radiometric Spectrometer (FIRRS)
[AD-A133552] N84-15527

AIRCRAFT HAZARDS
A systematic characterization of the effects of atmospheric electricity on the operational conditions of aircraft N84-15086

AIRCRAFT LANDING
Aircraft operations from airfields with special unconventional characteristics N84-15085
Influence of windshear on flight safety N84-15088
Computer based landing signal officer carrier aircraft recovery model
[AD-A133507] N84-15808

AIRCRAFT MAINTENANCE
First level integrated maintenance in weapons systems N84-15054
Job attitudes toward the new maintenance concept of the airway facilities service
[AD-A133282] N84-15793

AIRCRAFT MANEUVERS
The effect of superposing ripple loading of maneuver load cycles
[AD-A132653] N84-15148

AIRCRAFT NOISE
Aeroacoustics: Ten Years of Research — conferences
[VKI-LS-1983-05] N84-15025
Research towards and development of aerospace vehicle noise certification with emphasis on propeller aircraft and helicopters N84-15026
Helicopter noise N84-15027

Study of noise-certification standards for aircraft engines. Volume 2: Procedures for measuring far field sound pressure levels around an outdoor jet-engine test stand
[AD-A133408] N84-15158
Airport noise control strategies
[AD-A133137] N84-15900

AIRCRAFT RELIABILITY
The Civil Aircraft Airworthiness Data Recording Programme N84-15079

AIRCRAFT SAFETY
The Civil Aircraft Airworthiness Data Recording Programme N84-15079
Incident reporting: Its role in aviation safety and the acquisition of human error data N84-15081
Flight parameters recording for safety monitoring and investigations N84-15083
Aircraft operations from airfields with special unconventional characteristics N84-15085
Lessons learned in the development of the F-16 flight control system N84-15092
Ice formation in aircraft N84-15130
Airborne lightning characterization
[AD-A130627] N84-15733

AIRCRAFT SPIN
Pilot human factors in stall/spin accidents of supersonic fighter aircraft N84-15102

AIRCRAFT STRUCTURES
Recognizing defects in carbon-fiber reinforced plastics
[NASA-TM-76947] N84-15143
Report on visit to the US and Europe in May 1983, covering the 1983 ICAF (International Committee on Aeronautical Fatigue) Meetings and related visits
[AD-A133415] N84-15147

AIRCRAFT SURVIVABILITY
Lessons learned in the development of the F-16 flight control system N84-15092
Tornado autopilot measures to ensure survivability after failures N84-15094
Increased aircraft survivability using direct voice input N84-15100

AIRCRAFT TIRES
FOD (Foreign Object Damage) generation by aircraft tires — probability of engine ingestion and airfield surface movements
[AD-A133319] N84-15146
Heat generation in aircraft tires under braked rolling conditions
[NASA-CR-3768] N84-15587

AIRFOIL PROFILES
Three-dimensional effects on airfoils
[NASA-TM-77025] N84-15118
Computational procedures in transonic aerodynamic design
[NLR-MP-82020-U] N84-15131
Design procedures for compressor blades
[NASA-TM-77085] N84-15552

AIRFOILS
A model of the trailing edge separation on an airfoil
[AD-A126703] N84-15125
Aerothermal modeling. Executive summary
[NASA-CR-168330] N84-15152
Unsteady pressure and force measurements associated with transonic buffeting of a two-dimensional supercritical airfoil
[AD-A133139] N84-15503

AIRFRAME MATERIALS
Hardware-in-the-loop simulation techniques used in the development of the Sea Harrier avionic system N84-15071

AIRPORTS
Airport noise control strategies
[AD-A133137] N84-15900

ALGEBRA
A new numerical method for the transient gas-dyanmic code EVENT
[LA-9594-MS] N84-15977

ALGORITHMS
Design considerations for remotely piloted, high-altitude airplanes powered by microwave energy
[NASA-TM-85730] N84-15145
Stability of mechanical properties of cold-drawn rolled metal with high-temperature thermomechanical treatment
[BLL-M-35292-(5828.4)] N84-15233
Dynamic control of session input rates in communication networks
[AD-A133572] N84-15379
Second-order adaptive infinite impulse response filter
[DE84-001768] N84-15406
Fully coupled calculation of fluid flows with limited use of computer storage
[DE84-002218] N84-15508
Digital multishaker modal testing
[NASA-CR-170951] N84-15522
Support for the Naval Research Laboratory Environmental Passive Microwave Remote Sensing Program
[AD-A133330] N84-15526
General method for fatigue analysis of vertical axis wind turbine blades
[DE84-002654] N84-15613
Development of visible/infrared/microwave agriculture classification and biomass estimation algorithms, volume 2 — Oklahoma and Texas
[E84-10059] N84-15629
Adaptive protection of detecion systems operating by spread spectrum N84-15652
A comparison of NMC models (1977) on precipitation forecasts for east coast cyclogenesis N84-15720
Implementation of automatic focusing algorithms for a computer vision system with camera control
[AD-A133492] N84-15807
Tailored testing theory and practice: A basic model, normal ogive submodels, and tailored testing algorithms
[AD-A133385] N84-15824
A survey of network reliability
[AD-A133545] N84-15835
Direct multivariable model reference adaptive control with applications to large structural systems N84-15840
An algorithm for detecting a change in stochastic process
[AD-A134104] N84-15842
Application of the Gibbs distribution to image segmentation
[AD-A133406] N84-15850
The travelling salesman problem in graphs with 3-edge cutsets
[AD-A133504] N84-15852
Analytical and numerical solution for a solidifying liquid alloy slab N84-16025
Computer control of a seven degree of freedom manipulator arm N84-16051

ALLOYS
Corrosion research N84-15191
Powder metallurgy
[BLL-M-35271-(5828.4)] N84-15231
Calculation of structure factor for different cluster models of an amorphous alloy
[BLL-M-35293-(5828.4)] N84-15234
Use of the disk bend test to assess irradiation performance of structural alloys
[DE84-001484] N84-15255

ALOHA SYSTEM
Advanced teleprocessing systems
[AD-A133554] N84-15377

ALTITUDE SICKNESS
Variable inhibition by falling CO2 of hypoxic ventilatory response in man
[AD-A130658] N84-15768

ALUMINUM
Fracture behavior of unidirectional boron/aluminum composite laminates
[NASA-CR-3753] N84-15196
Potentiostatic investigation of the kinetics of the breakdown of the passivity of aluminium in aqueous medium
[BLL-OA-TRANS-3066-(6196.3)] N84-15238
Ion plating in corrosion protection
[DE84-001182] N84-15256
A small and light weight heat exchanger for on-board helium refrigerator N84-15339
Manufacturing technology for high quality swept-culture growth quartz
[AD-A133500] N84-15998
Studies of neutron and proton nuclear activation in low-Earth orbit 2 N84-16041

ALUMINUM ALLOYS
The effect of superposing ripple loading of maneuver load cycles
[AD-A132653] N84-15148
Choice of a melting installation for aluminum alloy
[BLL-OA-TRANS-3095-(6196.3)] N84-15239
Rapid solidification processing and powder metallurgy of Al alloys
[AD-A133873] N84-15250
Investigation of fatigue crack-growth resistance of aluminum alloys under spectrum loading
[AD-A133206] N84-15251
Fatigue crack propagation in Al-alloy lugs under constant amplitude and maneuver spectrum loading
[TAE-497] N84-15585

ALUMINUM GALLIUM ARSENIDES
AlGaAsSb vapor phase epitaxy and laser program
[AD-A133123] N84-15995
Organometallic epitaxy for GaAs/AlGaAs microwave transistors and integrated circuits
[AD-A133569] N84-16001

ALUMINUM OXIDES
Refined test methods in evaluating brittle material strengths
[AD-A133596] N84-15610

ALUMINUM SILICATES
The heterogeneous nucleation of ice I N84-15325

AMBIENT TEMPERATURE
Polymer coated electrodes in ambient temperature molten salts
[AD-A133202] N84-15220

AMBIGUITY
Ambiguity and uncertainty in probabilistic inference
[AD-A133418] N84-15872

AMBIPOLAR DIFFUSION
Ambipolar diffusion in interstellar clouds: One-dimensional, isothermal collapse N84-16099

AMINES
Synthesis of N-substituted silaneamines: Monomeric precursors of silicon carbide-nitride fibers N84-16033

AMMONIUM PERCHLORATES
Combustion at the interface of an oxidizer-fuel slab system N84-15215

AMORPHOUS MATERIALS
Calculation of structure factor for different cluster models of an amorphous alloy
[BLL-M-35293-(5828.4)] N84-15234
Moessbauer spectroscopy study of amorphous Fe87B11Au2 ribbon and its crystallization products
[DE83-018091] N84-16010

AMPLIFICATION
Limiting energy spread at high laser intensities using phase space displacement
[AD-A133322] N84-15542

AMPLITUDES
The effect of superposing ripple loading of maneuver load cycles
[AD-A132653] N84-15148
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
The satellite applications of amplitude companded single sideband modulation N84-15391

AMPOULES
Complete sample analysis by gas chromatography
[BLL-T6213/BG/LRS/LRST671/83] N84-15212

ANALOG CIRCUITS
Analog fault diagnosis of large-scale electronic circuits
[AD-A133491] N84-15400

ANALOG TO DIGITAL CONVERTERS
ECM (Electronic Counter Measure) signal discrimination and identification techniques
[AD-A133427] N84-15372
The development of a digital processing system for accurate range determinations — for Teleoperator Maneuvering Systems N84-16046

ANALYSIS (MATHEMATICS)
Status of research at the Institute for Computer Applications in Science and Engineering (ICASE)
[NASA-CR-172267] N84-15811
Analytical and numerical solution for a solidifying liquid alloy slab N84-16025

ANALYTICAL CHEMISTRY
Activities of the National Chemical Research Laboratory
[CSIR-SR-CHEM-261] N84-15188
Analytical chemistry N84-15189

ANEMOMETERS
Design, construction, and use of a high-resolution, two-component LDA N84-15419

ANGULAR MOMENTUM
Ambipolar diffusion in interstellar clouds: One-dimensional, isothermal collapse N84-16099

ANISOTROPY
A study of the return to isotropy of homogeneous turbulence N84-15110
Lateral heterogeneity and azimuthal anistropy of the upper mantle: Love and Rayleigh waves 100-250 sec
[NASA-CR-174619] N84-15710

ANNEALING
Volume recovery in glasses: A free-volume diffusion process
[DE83-013771] N84-15280
Beam processing for high-efficiency Si solar cells
[DE84-002059] N84-15690
Evaluation of radiation damage to Metal-Oxide-Semiconductor (MOS) devices
[AD-A133593] N84-16002

ANNUAL VARIATIONS
Worldwide experience of wind shear during 1981-1982 N84-15087

ANNULAR PLATES
Elastic-plastic analysis of annular plate problems using NASTRAN N84-15807

ANNULI
The structure of turbulent entraining flow in an annulus with a rotating screen N84-15416

ANODES
Preliminary investigation of ceramic-coated anodes for cathodic protection
[AD-A133440] N84-15273
Calcium-thionyl chloride battery technology
[AD-A133570] N84-15401
ANOMALIES
Statistical data on anomalous propagation in the Tyrrhenian Sea using an X-band link N84-15668
A long range propagation experiment to investigate the incidence of anomalous propagation in the north Atlantic N84-15669
ANTARCTIC REGIONS
Investigation of antarctic crust and upper mantle using MAGSAT and other geophysical data
[E84-10065] N84-15627
ANTENNA ARRAYS
Phase-only nulling at symmetric pattern locations
[AD-A133128] N84-15361
Aperture efficiency considerations in the convolution synthesis of symmetrical hexagonal arrays
[AD-A133367] N84-15369
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371
Contending with jamming in decametric waves in an adaptive system of all-directional antennas N84-15653
ANTENNA RADIATION PATTERNS
Radiation patterns of an antenna mounted on the mid-section of an ellipsoid
[AD-A133203] N84-15365
Earth coverage corrugated horns (44.5 GHz and 20.7 GHz)
[AD-A133241] N84-15366
Millimeter wave guiding structures and antennas
[AD-A133528] N84-15376
Contending with jamming in decametric waves in an adaptive system of all-directional antennas N84-15653
ANTENNAS
Millimeter wave guiding structures and antennas
[AD-A133528] N84-15376
Numerical electromagnetics code. Method of moments. User's guide supplement for NEC-3 for modeling buried wires
[DE84-002195] N84-15382
Broadband base isolated asymmetrically fed VHF antenna N84-15393
Characteristics of RF lightning emission at 2 GHz and 250 MHz N84-16039
ANTHROPOMETRY
Development of an interactive computer program to produce body description data
[AD-A133720] N84-15822
ANTIKNOCK ADDITIVES
1981 CRC octane number requirement survey
[AD-A133369] N84-15288
ANTIMONY ALLOYS
InAsSb strained-layer superlattices for long wavelength detector applications
[DE84-001055] N84-16004
ANTIREFLECTION COATINGS
Photodetachment neutralizer development. Laser-resonator study. Volume 1: Summary
[DE84-001682] N84-15547
APERTURES
Aperture efficiency considerations in the convolution synthesis of symmetrical hexagonal arrays
[AD-A133367] N84-15369
APPALACHIAN MOUNTAINS (NORTH AMERICA)
Synthesis of regional crust and upper-mantle structure from seismic and gravity data
[E84-10061] N84-15631
APPROXIMATION
Asymptotic theory of an unseparated supersonic turbulent boundary layer at a compression corner N84-15112
Numerical electromagnetics code. Method of moments. User's guide supplement for NEC-3 for modeling buried wires
[DE84-002195] N84-15382
Introduction to the FORTRAN 14 programs Duvorol and Contact for the solution of 3 D elastostatic half-space contact problems with and without friction
[PB83-147421] N84-15833
Optimal reconstructions and n-widths
[AD-A133576] N84-15853
Numerical methods for tracking interfaces
[DE84-001730] N84-15854
The parabolic approximation for sound propagation in stratified moving media N84-15893
AQUEOUS SOLUTIONS
Potentiostatic investigation of the kinetics of the breakdown of the passivity of aluminium in aqueous medium
[BLL-OA-TRANS-3066-(6196.3)] N84-15238
Spectroscopic studies on surface reactions between minerals and reagents in flotation systems N84-15324
Thermodynamics of aqueous sodium chloride to 823 K and 1 kbar
[DE84-001841] N84-16019
ARC SPRAYING
Arc spray fabrication of metal matrix composite monotape --- high temperature fiber-reinforced superalloy composites
[NASA-CASE-LEW-13828-1] N84-15203
ARCHITECTURE (COMPUTERS)
Advanced Concepts for Avionics/Weapon System Design, Development and Integration
[AGARD-CP-343] N84-15034
System architecture: Key to future avionics capabilities N84-15035
Certification experience of the Jaguar fly-by-wire demonstrator aircraft integrated flight control system N84-15095
Multispectral Data Processing System (MDPS)
[AD-A133426] N84-15816
Perspectives on oversight management of software development projects
[AD-A133404] N84-16064
ARCTIC OCEAN
Geophysical data from drifting ice stations FRAM 4 and TRISTEN
[AD-A133370] N84-15640
ARCTIC REGIONS
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15651
Radiative-dynamic properties of Arctic stratus clouds and their possible modification by aerosol particles
[DFVLR-FB-83-23] N84-15740
The effects of dehydration on peripheral cooling
[AD-A130638] N84-15787
ARGON
Bone blood flow measured by (41)Ar clearance formed by (44)Ca(n,(-)) (41)Ar
[DE83-017600] N84-15761
ARPA COMPUTER NETWORK
A survey of network reliability
[AD-A133545] N84-15835
ARRAYS
Very Large Array observations of solar active regions. 4: Structure and evolution of radio bursts from 20 cm loops
[AD-A133907] N84-16109
ARRIVALS
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
ARTIFICIAL INTELLIGENCE
Artificial intelligence: An analysis of potential applications to training, performance measurement, and job performance aiding
[AD-A133592] N84-15839
Analyzing the roles of descriptions and actions in open systems
[AD-A133614] N84-15878
ASPHALT
Microwave methods and apparatus for paving and paving maintenance
[DE84-016306] N84-15359
ASTROPHYSICS
Design of an adiabatic demagnetization refrigerator for studies in astrophysics N84-15352
Problems in astrophysical radiation hydrodynamics
[DE84-000185] N84-16102
ASYMMETRY
Engineering evaluations and studies. Volume 3: Exhibit C
[NASA-CR-171727] N84-15177
Asymmetric turbulent flows N84-15451
ASYMPTOTIC METHODS
Asymptotic analysis of numerical wave propagation in finite difference equations
[NASA-CR-175323] N84-15360
An algorithm for detecting a change in stochastic process
[AD-A134104] N84-15842
Acoustic shocks in a variable area duct containing near sonic flows
[NASA-CR-172274] N84-15897
ATMOSPHERIC ATTENUATION
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1
[AD-A133587] N84-15380
Far Infrared Radiometric Spectrometer (FIRRS)
[AD-A133552] N84-15527
Laser radar analyses
[AD-A133295] N84-15540
Beam propagation experiment : study
[AD-A133310] N84-15946
ATMOSPHERIC CHEMISTRY
Significant scientific and technical results at Marshal Space Flight Center
[NASA-TM-82562] N84-16075
ATMOSPHERIC CIRCULATION
The structure of turbulent entraining flow in an annulus with a rotating screen N84-15416
Baroclinic instability of atmospheric jets N84-15704
Alternative experiments using the geophysical fluid flow cell
[NASA-CR-3766] N84-15706
Possible tidal modulation of the Indian monsoon onset N84-15721
A comparison study of the energetics of standing and transient eddies between two general circulation models: The GLAS Climate Model and the NCAR Community Climate Model N84-15726
Development and perturbation analysis of model stochastic equations for global circulation N84-15743
ATMOSPHERIC COMPOSITION
Analysis of severe storm data
[NASA-CR-170947] N84-15732
ATMOSPHERIC CONDUCTIVITY
Simulated precipitation reference materials, 4
[PB83-139378] N84-15742
ATMOSPHERIC EFFECTS
Clear atmospheric effects on insolation illustrated by broad-band radiometer measurements N84-15701
ATMOSPHERIC ELECTRICITY
A systematic characterization of the effects of atmospheric electricity on the operational conditions of aircraft N84-15086
ATMOSPHERIC MODELS
Data analysis and theoretical studies for atmospheric Explorer C, D and E
[NASA-CR-175121] N84-15711
Evaluation of 2 1-D cloud models for the analysis of VAS soundings
[NASA-CR-3771] N84-15729
Range reference atmosphere 0-30 km altitude, Eglin AFB, Florida
[AD-A133506] N84-15734
Taquac, Guam Island. Range reference atmosphere 0-30 km altitude
[AD-A133618] N84-15736
ATMOSPHERIC MOISTURE
The influence of the environment on the mechanical characteristics of composite materials: Design considerations --- polymer matrix composites
[INTA-INFORME-I-1/221/720/83047] N84-15281
ATMOSPHERIC PHYSICS
Significant scientific and technical results at Marshal Space Flight Center
[NASA-TM-82562] N84-16075
ATMOSPHERIC PRESSURE
Remote sensing of atmospheric pressure and sea state from satellites using short-pulse multicolor laser altimeters N84-15674
ATMOSPHERIC RADIATION
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
ATMOSPHERIC TEMPERATURE
An analysis of aircraft data collected in the Alboran Sea during Donde Va?, 6 - 18 October 1982
[AD-A133995] N84-15746
ATMOSPHERIC TIDES
Thermal tides in the atmosphere of Venus N84-15702
Possible tidal modulation of the Indian monsoon onset N84-15721
ATMOSPHERIC TURBULENCE
The effect of turbulent atmosphere on backscattered waves N84-15664
ATOMIC BEAMS
Laser optical pumping of sodium and lithium atom beams N84-15534
ATOMIC EXCITATIONS
Collisional-radiative model for helium-like ions: Application to intermediate-density plasmas
[IPPJ-647] N84-15976
ATOMIC STRUCTURE
Theoretical and experimental studies of the electronic structure of the Mo3(Micro3-0)(Micro3-OR)(Micro-OR)3(OR)6 type of triangulo metal atom cluster compound
[AD-A133516] N84-15951
Photoelectron studies of resonant multiphoton ionization of CO via the A-1 Pi state
[DE83-008535] N84-15956
ATOMIZING
Atomization and mixing study
[NASA-CR-170943] N84-15284
Atomization and mixing study
[NASA-CR-170943] N84-15428

ATROPINE
Heat exchange following atropine injection before and after heat acclimation
[AD-A132618] N84-15780
ATTACK AIRCRAFT
Computer aided construction of ground attack mission profiles over European terrain N84-15060
Physiological and psychological aspects of the piloting of modern high-performance combat aircraft N84-15099
ATTENUATION
Constraints on the Earth's anelastic and aspherical structure from antipodal surface waves N84-15700
ATTITUDE CONTROL
Propulsion apparatus and method using boil-off gas from a cryogenic liquid --- controlling spacecraft attitude and drag
[NASA-CASE-MFS-25946-1] N84-15183
Fine pointing control of the solar UV telescope on the sounding rocket S-520-5
[ISAS-608] N84-16094
ATTITUDE INDICATORS
A study on airborne integrated display system and human information processing
[NASA-TM-77338] N84-15789
AUGER SPECTROSCOPY
Proceedings of Symposium on Surface Science and its Industrial Implications
[ISBN-0-7988-2417-4] N84-15298
Experience in surface analysis applied to technical material problems N84-15303
The use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition N84-15307
Surface segration and diffusion investigations by means of AES N84-15319
AUSTENITIC STAINLESS STEELS
Corrosion of TIG welded austenitic stainless steels
[BLL-WINDSCALE-TR-959-(9091.F)] N84-15235
Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy
[DE84-001985] N84-15257
Yield stress of type 21-6-9 stainless steel over a wide range of strain rate (10(-5) to 10-4 s(-1)) and temperature
[DE83-017159] N84-15259
AUTOMATA THEORY
A learning approach to routing in data communication networks
[REPT-8212] N84-15834
AUTOMATIC CONTROL
Implementation of automatic focusing algorithms for a computer vision system with camera control
[AD-A133492] N84-15807
Laboratory automation of a quadrupole mass spectrometer N84-16053
AUTOMATIC FLIGHT CONTROL
AFTI/F-16: An integrated system approach to combat automation N84-15063
Nonlinear transformat
[NASA-CR-166506] N84-15877
AUTOMATIC PILOTS
Tornado autopilot measures to ensure survivability after failures N84-15094
AUTOMATION
Automating the testing of software N84-15074
Advanced automation program. Program master plan
[DOT/FAA/AP-83/3] N84-15139
Composite laminate weight optimization on the HX-20
[AD-A133490] N84-15207
Analog fault diagnosis of large-scale electronic circuits
[AD-A133491] N84-15400
A distributed control system for the CMU Rover
[AD-A133201] N84-15802
A modular twin bus microprocessor system for laboratory automation
[AD-A133372] N84-15815
AUTOMOBILE ENGINES
Advanced Gas Turbine (AGT) technology development
[NASA-CR-168235] N84-15554
AUTOMOBILE FUELS
Gasogen for automobile use
[DE84-000712] N84-15291
AUTOMOBILES
1981 CRC octane number requirement survey
[AD-A133369] N84-15288
1981 CRC (Coordinating Research Council) diesel fuel low-temperature operability field test
[AD-A133543] N84-15289
Recycling the kinetic energy of an automobile
[DE83-004201] N84-15551
AUTOROTATION
New, high performance rotating parachute --- reentry vehicle recovery
[DE84-002382] N84-15129
AVIONICS
Advanced Concepts for Avionics/Weapon System Design, Development and Integration
[AGARD-CP-343] N84-15034
System architecture: Key to future avionics capabilities N84-15035
Tactical requirements impact on avionics/weapon system design N84-15036
Operational readiness and its impact on fighter avionics system design N84-15037
Avionics concept evaluation at the force level N84-15038
Towards a modularity of software conceived for the requirement of the user N84-15040
Increasing significance of electromagnetic effects in modern aircraft development N84-15041
Avionics/crew station integration N84-15042
Combined visualization N84-15043
Guidelines and criteria for the functional integration of avionic systems with crew members in command N84-15044
Towards the functional partitioning of highly integrated, fault tolerant avionics signal processors N84-15047
Advanced F/A-18 avionics N84-15048
DEF STAN 00-18: A family of compatible digital interface standards N84-15049
Techniques for interbus communication in a multibus avionic system N84-15050
Network communications for a distributed avionics system N84-15052
Avionics fault tree analyzer N84-15053
First level integrated maintenance in weapons systems N84-15054
Computer graphics techniques for aircraft EMC analysis and design N84-15055
CASCADE: A design environment for future avionic systems N84-15057
A practical approach to the design of a new avionic system N84-15058
Integration of ICNIA into advanced high performance fighter aircraft N84-15059
Critical factors and operational research in tactical fighter avionic system development N84-15062
AFTI/F-16: An integrated system approach to combat automation N84-15063
CADAS: A computer aided design tool for avionic systems N84-15065
Design and verification of electromagnetic compatibility in airborne weapons systems N84-15066
Design, development and flight test of a demonstration advanced avionics system N84-15067
Concepts for avionic and weapon integration facilities N84-15070
Hardware-in-the-loop simulation techniques used in the development of the Sea Harrier avionic system N84-15071
Simulation requirements to support the development of a fault tolerant avionic system N84-15072
Software testing of safety critical systems N84-15073
A dynamic approach to military avionics systems testing N84-15075
The man-machine interface in new generation commercial aircraft N84-15096
Validation of digital systems in avionics and flight control applications handbook, volume 1
[AD-A133222] N84-15150
AFTI/F-16 flight test results and lessons
[NASA-TM-84920] N84-15159
AXIAL FLOW TURBINES
Turbine aerodynamic design using through-flow theory. Meridional through-flow calculation N84-15474
A review of current research activity on the aerodynamics of axial flow turbines N84-15480
AXIAL STRAIN
Analysis of interlaminar stresses in thick composite laminates with and without edge delamination
[NASA-TM-85738] N84-15201
AXISYMMETRIC FLOW
The CARS spectroscopy in a supersonic jet N84-15216
AZIMUTH
Lateral heterogeneity and azimuthal anistropy of the upper mantle: Love and Rayleigh waves 100-250 sec
[NASA-CR-174819] N84-15710

B

B-52 AIRCRAFT
Preflight transient dynamic analyses of B-52 aircraft carrying Space Shuttle solid rocket booster drop-test vehicle
[NASA-TM-84925] N84-15588
BACKGROUND RADIATION
Far Infrared Radiometric Spectrometer (FIRRS)
[AD-A133552] N84-15527
BACKSCATTERING
Surface and near-surface analysis of diamond by RBS N84-15302
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
The effect of turbulent atmosphere on backscattered waves N84-15664
The nature of microwave backscattering from water waves N84-15665
Multiple paths on the ocean surface N84-15666
Variation of laser absorption with plasma scalelength in long-scalelength plasmas
[DE84-002743] N84-15991
BACTERIA
Biological chemistry N84-15190
The role of microorganisms in marine corrosion processes
[AD-A133113] N84-15757
BAFFLES
Liquid management in low gravity using baffled rotating containers
[NASA-TP-2263] N84-15427
BALANCE
A note on the analysis of random balance designs
[AD-A133287] N84-15848
BALL BEARINGS
Thermal conductance and torque of thin section four-point contact ball bearings in vacuum
[ESA-ESTL-54] N84-15562
BALLOON-BORNE INSTRUMENTS
A mercuric detector system for X-ray astronomy. 2. Results from flight tests of a balloon borne instrument
[NASA-CR-175329] N84-16095
BANDPASS FILTERS
A representation for shape based on peaks and ridges in the difference of low-pass transform
[AD-A133299] N84-15849
BAROCLINIC INSTABILITY
Baroclinic instability of atmospheric jets N84-15704
Alternative experiments using the geophysical fluid flow cell
[NASA-CR-3766] N84-15706
BAROCLINIC WAVES
Alternative experiments using the geophysical fluid flow cell
[NASA-CR-3766] N84-15706
BARS
A three-dimensional photoelastic investigation of stresses and cracks formed in concrete around deformed reinforcing bars N84-15621
BATCH PROCESSING
The creation of the NLR benchmark package and the performance of two new CDC comuters with it
[NLR-MP-82015-U] N84-15819
BATHS
The descaling of 3Cr12 steel N84-15322
BATHYMETERS
Multispectral Data Processing System (MDPS)
[AD-A133426] N84-15816
BATHYTHERMOGRAPHS
Expendable bathythermograph (XBT) measurements in the Western Alboran Sea, October 1982
[AD-A133939] N84-15748
BAYES THEOREM
Tailored testing theory and practice: A basic model, nonlinear ogive submodels, and tailored testing algorithms
[AD-A133385] N84-15824
On Bayes and empirical bayes rules for selecting good populations
[AD-A133336] N84-15869
BEACONS
A review of underwater acoustic systems and methods for locating objects lost at sea
[NASA-TM-85727] N84-15898
BEAM CURRENTS
Beam current limitations due to instabilities in modified and conventional betatrons
[AD-A133337] N84-15947
BEAM NEUTRALIZATION
Photodetachment neutralizer development. Laser-resonator study. Volume 1: Summary
[DE84-001682] N84-15547
BEAMS (RADIATION)
Application of the density matrix multipole expansion to stark quantum beats from beam-foil-excited hydrogen atoms
[AD-A133603] N84-15193
Adaptive arrays for multiple simultaneous desired signals
[AD-A133486] N84-15373
BEAMS (SUPPORTS)
A periodically forced piecewise linear oscillator N84-15577

The dynamic response characteristics of a viscoelastic beam on periodically-spaced, viscoelastic supports N84-15619

BEARING (DIRECTION)
Spatiotemporal characteristics of visual localization [AD-A133952] N84-15770

BEARINGS
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
Interactive mechanisms of sliding-surface bearings [AD-A133127] N84-15556

BENDING
Use of the disk bend test to assess irradiation performance of structural alloys [DE84-001484] N84-15255
Theoretical and experimental determination of stress-strain of high-pressure equipment [BLL-M-35287-(5828.4)] N84-15574

BERYLLIUM
Further abbreviation of the machining schedule for producing surface-damage-free beryllium [DOE/TIC-4500-REV-69] N84-15297

BERYLLIUM ALLOYS
Superconducting ground state of a strongly interacting electron system: UBe13 [DE84-001708] N84-16003

BETA FACTOR
Elimination of stochasticity in stellarators [DE84-001560] N84-15985

BETATRONS
Dynamics of a high current electron ring in a conventional betatron accelerator [AD-A133291] N84-15945
Beam current limitations due to instabilities in modified and conventional betatrons [AD-A133337] N84-15947

BIAS
Passive source localization from spatially correlated angle-of-arrival data [AD-A133141] N84-15362

BIBLIOGRAPHIES
Chemical vapor deposition of group IVB, VB, and VIB elements with nonmetals. A literature review [PB83-225409] N84-15228
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 252) [NASA-SP-7011(252)] N84-15763

BINARY ALLOYS
Analytical and numerical solution for a solidifying liquid alloy slab N84-16025
Determination of systems suitable for study as monotectic binary metallic alloy solidification models N84-16050

BINARY STARS
Ambipolar diffusion in interstellar clouds: One-dimensional, isothermal collapse N84-16099

BINARY SYSTEMS (MATERIALS)
Observations on the vanadium-nitrogen system and on pure metallic vanadium [CSIR-TRANS-1706] N84-15243

BIOASSAY
A preliminary survey of plankton and periphyton in the Turn Barge Canal and basin area of Kennedy Space Center, Florida N84-16027

BIOCHEMISTRY
Activities of the National Chemical Research Laboratory [CSIR-SR-CHEM-261] N84-15188
Biological chemistry N84-15190
Environmental behavior of Technetium-99 [DP-1644] N84-15245

BIODYNAMICS
Stress fractures: The remodelling response to excessive repetitive loading [AD-A130881] N84-15765
Development of an interactive computer program to produce body description data [AD-A133720] N84-15822

BIOELECTRICITY
Neuronal adaptive mechanisms underlying intelligent information processing [AD-A133694] N84-15776

BIOINSTRUMENTATION
Immobilization of biomolecules on semiconductor surfaces [FOA-C-40178-C2(B2,A3)] N84-15408

BIOLOGICAL EFFECTS
Status of research in progress at the Inhalation Toxicology Research Institute [DE83-012610] N84-15694
Duration of memory loss due to electron beam exposure [AD-A132941] N84-15760
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 252) [NASA-SP-7011(252)] N84-15763

BIONICS
Lethal, potentially lethal lesion model [DE84-001325] N84-15762
Visual routines [AD-A133634] N84-15792

BIOTECHNOLOGY
European Scientific Notes. Volume 37, number 9 [AD-A133558] N84-16079

BIRD-AIRCRAFT COLLISIONS
Capabilities of the NRCC/NAE flight impact simulator facility [AD-A130849] N84-15136

BIVARIATE ANALYSIS
Assessment of Fisher and logistic linear quadratic discrimation models [ORNL/CSD-TM-200] N84-15865
Some properties of a 5-parameter bivariate probability distribution [NASA-TM-82550] N84-15866

BLACK HOLES (ASTRONOMY)
Electromagnetic, gravitational, and neutrino waves in flat and curved spacetime N84-16111

BLADE TIPS
Helicopter blade tips [NASA-TM-77370] N84-15119

BLAST LOADS
Interaction of gas explosions with buildings N84-15447

BLOCKS
Plastic flows of tubes and blocks N84-15421

BLOOD FLOW
Bone blood flow measured by (41)Ar clearance formed by (44)Ca(n,(-)) (41)Ar [DE83-017600] N84-15761

BOATS
Analysis of US Coast Guard HU-25A visual and radar detection performance [AD-A133380] N84-15138

BODY CENTERED CUBIC LATTICES
Structural properties of epitaxial single layer metals on (110) B.C.C. metal substrates N84-15326

BODY FLUIDS
The effects of dehydration on peripheral cooling [AD-A130838] N84-15767

BODY-WING AND TAIL CONFIGURATIONS
Wind tunnel investigations of glider fuselages with different waistings and wing arrangements N84-15116
New investigation of short wings with lateral jets [NASA-TM-77347] N84-15124

BOILING
Studies on sodium boiling phenomena in out of pile rod bundles for various accidental situations in Liquid Metal Fast Breeder Reactors (LMFBR) experiments and interpretations N84-15493
Temperature distributions, boiling and dry-out behind local blockages --- liquid metal fast breeder reactors (LMFBR) N84-15495
Sodium boiling experiments in bundle geometries under fast transient and steady state conditions --- fast breeder reactor safety analysis N84-15496
Computation of the thermohydraulics in subassemblies for accident situations --- liquid metal fast breeder reactors (LMFBR) N84-15499

BOLOMETERS
Design of an adiabatic demagnetization refrigerator for studies in astrophysics N84-15352
On 3He bolometer systems [NASA-CR-175325] N84-15520

BOLTS
Bolt in bore boundaries N84-15608

BOMBS (ORDNANCE)
Connecting aircraft and external loads N84-15046

BONDING
Feasibility of thermal NDE methods for Naval thermal spray coatings [DE84-001463] N84-15569

BONES
Bone blood flow measured by (41)Ar clearance formed by (44)Ca(n,(-)) (41)Ar [DE83-017600] N84-15761
Stress fractures: The remodelling response to excessive repetitive loading [AD-A130881] N84-15765

BOROHYDRIDES
Catalysis of nitramine propellants by mmtal borohydrides [AD-A133215] N84-15285

BORON
Beam processing for high-efficiency Si solar cells [DE84-002059] N84-15690

BORON ALLOYS
Moessbauer spectroscopy study of amorphous Fe87B11Au2 ribbon and its crystallization products [DE83-018091] N84-16010

BORON FIBERS
Fracture behavior of unidirectional boron/aluminum composite laminates [NASA-CR-3753] N84-15196

BOSONS
Search for Hadron jets and large transverse momentum electrons at the SPS pp collider N84-15913

BOUNDARIES
Numerical methods for tracking interfaces [DE84-001730] N84-15854

BOUNDARY ELEMENT METHOD
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics [AD-A133142] N84-15843

BOUNDARY INTEGRAL METHOD
Some new developments in exact integral equation formulations for sub- or transonic potential flow [NLR-MP-82024-U] N84-15860

BOUNDARY LAYER EQUATIONS
Three-dimensional, time-dependent, compressible, turbulent, integral boundary-layer equations in general curvilinear coordinates and their numerical solution [AD-A133289] N84-15504

BOUNDARY LAYER FLOW
Experimental mixed convection heat transfer from a large vertical surface in a horizontal flow N84-15412
Large scale motion in turbulent boundary layers N84-15455
Some aspects of two-dimensional compressible turbulent boundary layers N84-15456
Effects of unsteadiness on turbulent boundary layers N84-15457
Three-dimensional turbulent boundary layers N84-15459

BOUNDARY LAYER SEPARATION
A model of the trailing edge separation on an airfoil [AD-A126703] N84-15125

BOUNDARY LAYER STABILITY
Results from a two-layer and a reduced gravity model of the Alboran Sea; and vertical shear from tops [AD-A133753] N84-15752

BOUNDARY LAYER TRANSITION
Cavitation inception observations on axisymmetric headforms with turbulence stimulators [AD-A133517] N84-15506

BOUNDARY LAYERS
An experimental investigation of the boundary layer structures in a partially-filled horizontal and rapidly-rotating cylinder N84-15414
The Norwegian Seismic Array (NORSAR). Phase 3 [AD-A134038] N84-15713

BOUNDARY VALUE PROBLEMS
Solution of elastic and elasto-plastic problems by the method of lines N84-15573
Analysis of plates by the initial-value method N84-15622
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics [AD-A133142] N84-15843
Numerical modeling and fast-solver calculation of approximately normal shocks [NLR-MP-82026-U] N84-15858

BOW WAVES
On the relationship between collisionless shock structure and energetic particle acceleration [NASA-CR-175328] N84-15909

BRAIN
Neuronal adaptive mechanisms underlying intelligent information processing [AD-A133694] N84-15776

BRAKING
Heat generation in aircraft tires under braked rolling conditions [NASA-CR-3768] N84-15587

BRANCHING (MATHEMATICS)
Bifurcations in nonlinear problems of hydrodynamic instability of plane parallel shear flows N84-15411
A periodically forced piecewise linear oscillator N84-15577
Introduction to dynamic bifurcation [AD-A133252] N84-15846

BRAYTON CYCLE
Evaluation of air-cooled central receivers [DE83-005130] N84-15423

BRAZING
Advantages of using diamond tools brazed under high vacuum [CSIR-TRANS-1709] N84-15293

BREEDER REACTORS
Use of the disk bend test to assess irradiation performance of structural alloys [DE84-001484] N84-15255

BRIGHTNESS TEMPERATURE
Support for the Naval Research Laboratory Environmental Passive Microwave Remote Sensing Program
[AD-A133330] N84-15526
Thermal tides in the atmosphere of Venus N84-15702
Snow thickness and brightness temperature on multi-year ice
[AD-A133940] N84-15747
BRITTLE MATERIALS
Refined test methods in evaluating brittle material strengths
[AD-A133596] N84-15610
BRITTLENESS
Investigations on the reproducibility of the results of drop weight tests by the method of W. S. Pellini
[BLL-DRIC-T-6970-(3623.66)] N84-15517
Microcrack damage model of brittle rock
[DE84-002088] N84-15717
BROADBAND
Broadband base isolated asymmetrically fed VHF antenna N84-15393
BROADCASTING
Advanced teleprocessing systems
[AD-A133525] N84-15375
BROKEN SYMMETRY
Electron-electron interactions and broken symmetry in one dimension
[DE84-001704] N84-16014
BUBBLE TECHNIQUE
An experimental investigation of the structure of a turbulent reattaching flow behind a backward-facing step N84-15415
BUCKLING
Miniature center-cracked-tension specimen for fatigue crack growth testing
[DE84-001470] N84-15615
BUMPY TORUSES
Radial structure of curvature-driven instabilities in hot-electron plasma
[DE84-002256] N84-15986
BURNING RATE
Combustion at the interface of an oxidizer-fuel slab system N84-15215
Transport algorithms for methane flames
[AD-A133213] N84-15221
Catalysis of nitramine propellants by mmtal borohydrides
[AD-A133215] N84-15285
BURSTS
The bursting phenomenon in bounded shear flows N84-15454
BUS CONDUCTORS
Techniques for interbus communication in a multibus avionic system N84-15050
A video bus for weapon system integration N84-15051
A modular twin bus microprocessor system for laboratory automation
[AD-A133372] N84-15815

C

CADMIUM TELLURIDES
Progress in polycrystalline thin-film solar cells
[DE83-012131] N84-15691
Replicated CdTe substrates
[AD-A133114] N84-15994
CALCIUM
Bone blood flow measured by (41)Ar clearance formed by (44)Ca(n,(-)) (41)Ar
[DE83-017600] N84-15761
CALCIUM CHLORIDES
Calcium-thionyl chloride battery technology
[AD-A133570] N84-15401
CALIBRATING
Design and initial operational characteristics of a shock tube-Raman scattering calibration system
[AD-A133251] N84-15525
Study of the onboard calibration equipment of the HRV camera --- SPOT satellite
[ESA-TT-794] N84-15529
Calibration of air-data systems and flow direction sensors. AGARD Flight Test Techniques Series, volume 1
[AGARD-AG-300-VOL-1] N84-15530
In-flight absolute radiometric calibration of the thematic mapper
[E84-10064] N84-15833
Laboratory robotics at the Savannah River Laboratory
[DE84-001760] N84-15810
Preliminary designs for modifications to the X-ray source and beam monitor of the Marshall Space Flight Center's X-ray Calibration Facility N84-16032
CALIFORNIA
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields --- California and Pennsylvania
[E84-10057] N84-15626
CALORIMETERS
The design and expected performance of a fast scintillator hadron calorimeter N84-15926
Scintillation chamber operation of calorimters for colliding beam detectors N84-15927
Calorimetry at L = 10/sup 33 N84-15931
Operation of a high-P/sub T spectrometer arm at 10/sup 33 cm-2 sec-1 with particle identification N84-15937
Muons and electrons in general N84-15938
CAMERAS
Implementation of automatic focusing algorithms for a computer vision system with camera control
[AD-A133492] N84-15807
CANARD CONFIGURATIONS
Wake characteristics and interactions of the Canard/wing lifting surface configuration of the X-29 forward-swept wing flight demonstrator
[AD-A133188] N84-15126
CANONICAL FORMS
Nonlinear transformat
[NASA-CR-166506] N84-15877
CANOPIES (VEGETATION)
A correlation analysis of percent canopy closure versus TMS spectral response for selected forest sites in the San Juan National Forest, Colorado
[E84-10066] N84-15635
CAPACITORS
Novette pulse-power-system description
[DE83-018185] N84-15968
Evaluation of radiation damage to Metal-Oxide-Semiconductor (MOS) devices
[AD-A133593] N84-16002
CAPE KENNEDY LAUNCH COMPLEX
A preliminary survey of plankton and periphyton in the Turn Barge Canal and basin area of Kennedy Space Center, Florida N84-16027
Chronology of KSC and KSC related events for 1981
[NASA-TM-85510] N84-16060
CAPILLARY TUBES
Complete sample analysis by gas chromatography,
[BLL-T6213/BG/LRS/LRST671/83] N84-15212
CAPTURE EFFECT
Giant dipole resonances built on excited states
[DE84-001549] N84-15954
CARBENES
The chemistry of transition metal carbene complexes
[AD-A133541] N84-15225
CARBIDES
Theoretical and experimental determination of stress-strain of high-pressure equipment
[BLL-M-35287-(5828.4)] N84-15574
CARBON DIOXIDE
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246
Response to W. W. Kellogg carbon dioxide and climatic change: Implications for mankind's future
[DE84-002723] N84-15737
Variable inhibition by falling CO2 of hypoxic ventilatory response in man
[AD-A130658] N84-15768
Some issues related to evolution of planetary atmospheres N84-16103
CARBON DIOXIDE LASERS
A computer model for an imaging coherent laser radar
[FOA-C-30341-E] N84-15388
CARBON FIBER REINFORCED PLASTICS
Recognizing defects in carbon-fiber reinforced plastics
[NASA-TM-76947] N84-15143
CARBON FIBERS
Mechanical property characterization of F-100/934 graphite-epoxy composite material N84-16031
CARBON MONOXIDE
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246
Neurobehavioral effects of carbon monoxide (CO) exposure in humans protocol 1
[AD-A133891] N84-15774
Photoelectron studies of resonant multiphoton ionization of CO via the A-1 Pi state
[DE83-008535] N84-15958
CARBON STEELS
Aspects of damping of sonic vibrations due to impact loading in plate steels
[BLL-M-35295-(5828.4)] N84-15895
CARBON 13
High-resolution solid-state (13)C NMR study of the templating cations in tetrapropylammonium fluoride silicalite: The effect of steric interactions
[DE83-011706] N84-16013
CARTESIAN COORDINATES
IRIG standard for distributing interrange vector acquisition data
[AD-A133617] N84-15170
CASCADE CONTROL
Cascade Joule-Thomson refrigerators N84-15354
CASCADE FLOW
A lower-upper factored implicit scheme for the numerical solution of the Euler equations applied to arbitrary cascades N84-15111
Two dimensional condensing flow in transonic turbine cascades N84-15484
CASTINGS
Choice of a melting installation for aluminum alloy
[BLL-OA-TRANS-3095-(6196.3)] N84-15239
CATALYSIS
Catalysis of nitramine propellants by mmtal borohydrides
[AD-A133215] N84-15285
CATALYSTS
Inorganic chemistry N84-15192
European Scientific Notes. Volume 37, number 9
[AD-A133558] N84-16079
CATALYTIC ACTIVITY
Clean catalytic combustor program
[NASA-CR-168323] N84-15151
Inorganic chemistry N84-15192
Investigation of a para-ortho hydrogen reactor for application to spacecraft sensor cooling
[NASA-CR-175131] N84-15957
CATHODE RAY TUBES
Color display technology in advanced fighter cockpits N84-15061
Displaying colors of specified chrominance on a color graphics display
[AD-A133591] N84-15817
CATHODES
Preliminary investigation of ceramic-coated anodes for cathodic protection
[AD-A133440] N84-15273
CATTLE
Biological chemistry N84-15190
CAUSES
Investigation, reporting and analysis of US Army aircraft accident N84-15077
CAVITATION FLOW
The effect of flow oscillations on cavity drag, and a technique for their control N84-15109
Cavitation inception observations on axisymmetric headforms with turbulence stimulators
[AD-A133517] N84-15506
CAVITIES
The effect of flow oscillations on cavity drag, and a technique for their control N84-15109
Mach 0.6 to 3.0 flows over rectangular cavities
[AD-A134579] N84-15121
Grain boundary segregation and cavity formation in creep embrittled Cr-Mo steels N84-15320
CAVITY RESONATORS
Periodic flow noise reduction using flow-excited resonators: Theory and application --- centrifugal fans
[DFVLR-FB-83-29] N84-15409
Maser cavity servo-tuning system
[NASA-CASE-NPO-15890-1] N84-15536
Two-stage FEL (Free Electron Laser) program
[AD-A133508] N84-15546
CDC COMPUTERS
Vector coding the finite volume procedure for the CYBER 205 N84-15485
CDC CYBER 170 SERIES COMPUTERS
The creation of the NLR benchmark package and the performance of two new CDC comuters with it
[NLR-MP-82015-U] N84-15819
CELLS (BIOLOGY)
New polymers for low-gravity purification of cells by phase partitioning
[NASA-CR-170957] N84-15267
Countercurrent distribution of biological cells
[NASA-CR-170958] N84-15755
Lethal, potentially lethal lesion model
[DE84-001325] N84-15762
CENTAUR LAUNCH VEHICLE
Engineering evaluations and studies. Volume 2: Exhibit B, part 2
[NASA-CR-171726] N84-15176
CENTRIFUGAL COMPRESSORS
Periodic flow noise reduction using flow-excited resonators: Theory and application --- centrifugal fans
[DFVLR-FB-83-29] N84-15409

CERAMIC COATINGS
Comparative study of TiN hard coatings produced by reactive sputtering, ion-plating and CVD technique [BLL-RARDE-TR-1094(7291.7965)] N84-15236
Preliminary investigation of ceramic-coated anodes for cathodic protection [AD-A133440] N84-15273

CERAMICS
Metals and ceramics research: Processing, properties, and applications [ORNL-5943] N84-15187
Energy Materials Coordinating Committee (EMACC). Contractors Meeting on Problems and Opportunities in Structural Ceramics [CONF-8209111] N84-15266
Screening and classification of ceramic powders [NASA-TM-77092] N84-15270
Advanced Gas Turbine (AGT) technology development [NASA-CR-168235] N84-15554
Refined test methods in evaluating brittle material strengths [AD-A133596] N84-15810

CEREBRAL CORTEX
Evaluation of factors producing visual evoked response variability [AD-A133917] N84-15772

CERENKOV RADIATION
Prospects for Cerenkov ring imaging at hadron colliders N84-15934

CERTIFICATION
Research towards and development of aerospace vehicle noise certification with emphasis on propeller aircraft and helicopters N84-15026
Certification experience with methods for minimum crew demonstration N84-15101

CHANNEL FLOW
The core region of channel flows N84-15452
Computation of turbulent gas-particle suspension flows in channels N84-15470

CHANNEL MULTIPLIERS
Proton electrostatic analyzer [AD-A133586] N84-15528

CHARGE TRANSFER
Development of an XUV amplifier N84-15532
Emission of short-wavelength photons from ion-surface charge exchange [AD-A133183] N84-15942
Thermal and electrical interaction of tantalum with a low temperature chemically active plasma flow [NASA-TM-77374] N84-15980

CHARGED PARTICLES
Surface analysis by particle beams N84-15301
The problem of tracking charged particles in the cores of high energy jets in a high rate environment N84-15916
Prospects for Cerenkov ring imaging at hadron colliders N84-15934

CHARTS
Multispectral Data Processing System (MDPS) [AD-A133426] N84-15816

CHEBYSHEV APPROXIMATION
Higher order approximations in fluid mechanisms: Compact to spectral N84-15466

CHECKOUT
Avionics fault tree analyzer N84-15053
The debugging of real time multiprocessor systems: An integrated solution proposal [CISE-2067] N84-15837

CHEMICAL ANALYSIS
Increased confidence in spectrum matching by use of a retention time library — compound identification in industrial effluents [PB83-232090] N84-15229
Surface analysis by particle beams N84-15301
Simulated precipitation reference materials, 4 [PB83-139378] N84-15742

CHEMICAL BONDS
High-resolution solid-state (13)C NMR study of the templating cations in tetrapropylammonium fluoride silicalite: The effect of steric interactions [DE83-011706] N84-16013

CHEMICAL COMPOSITION
Stability of mechanical properties of cold-drawn rolled metal with high-temperature thermomechanical treatment [BLL-M-35292-(5828.4)] N84-15233
Observations on the vanadium-nitrogen system and on pure metallic vanadium [CSIR-TRANS-1708] N84-15243
Pit initiation resistance of ferritic stainless steels in chloride environments from 800 to 2600C [DE84-000355] N84-15258
Synthesis and characterization of some thermotropic nematic and cholesteric polymers N84-15262
Polymer characterization by electrohydrodynamic ionization mass spectrometry: Probing composition and chemistry of mixtures in solution N84-15264
Experience in surface analysis applied to technical material problems N84-15303

CHEMICAL EXPLOSIONS
LARC: Computer codes for Lagrangian analysis of stress-guage data to obtain decomposition rates through correlation to thermodynamic variables [DE84-002404] N84-15292

CHEMICAL PROPERTIES
Environmental behavior of Technetium-99 [DP-1644] N84-15245
The unique surface properties of gold N84-15310
On the functional dependence of the freezing point of soils on the composition of water soluble salts in an interstitial solution [NRC/CNR-TT-2070] N84-15707

CHEMICAL REACTIONS
Chemical kinetics modeling of engine knock: Preliminary results [DE84-001236] N84-15226
Observations on the vanadium-nitrogen system and on pure metallic vanadium [CSIR-TRANS-1708] N84-15243
Polymer characterization by electrohydrodynamic ionization mass spectrometry: Probing composition and chemistry of mixtures in solution N84-15264
Relationship between the glass transition temperature and the chemical structure of polymers [RAE-LIB-TRANS-2098] N84-15265
New polymers for low-gravity purification of cells by phase partitioning [NASA-CR-170957] N84-15267
Influence of Ar + CO2 shielding on the composition of a Cr-Mo-V weld [BLL-CE-TRANS-8000-(9022.09)] N84-15550

CHEMICAL REACTORS
Investigation of a para-ortho hydrogen reactor for application to spacecraft sensor cooling [NASA-CR-175131] N84-15957

CHEMOTHERAPY
Acute intramuscular toxicity (LD50) of 1,1'-trimethylenebis (4-(hydroxyiminomethyl) pyridinium bromide) monohydrate, (TMB-4) in male mice [AD-A133148] N84-15758

CHINA
First UFO incident for our country [AD-A133326] N84-16058

CHLORIDES
Pit initiation resistance of ferritic stainless steels in chloride environments from 800 to 2600C [DE84-000355] N84-15258
Part 1: Physical studies of distant comets. Part 2: Morphologies of planetary nebulae N84-16091

CHROMATOGRAPHY
Analytical chemistry N84-15189

CHROMIUM STEELS
Grain boundary segregation and cavity formation in creep embrittled Cr-Mo steels N84-15320
Evaluation of the pitting corrosion resistance of a Fe-12% Cr alloy N84-15321
The descaling of 3Cr12 steel N84-15322

CIRCADIAN RHYTHMS
Sleep and wakefulness handbook for flight medical officers [AGARD-AG-270(FR)] N84-15788

CIRCUITS
Calculation of cosmic ray induced single event upsets: Program CRUP (Cosmic Ray Upset Program) [AD-A133620] N84-16113

CIRCULAR CONES
Optimization of waverider configurations generated from non-axisymmetric flows past a nearly circular cone N84-15108

CIRCULAR CYLINDERS
Bending elasticity of circularly notched bars as monolithic flexure hinges in precision mechanisms [DE84-002199] N84-15612

CIRCULAR POLARIZATION
The circularly polarized sun at 12.6 cm wavelength [AD-A133668] N84-16110

CIRCULAR TUBES
An experimental study of steady and pulsating heat transfer in curved tubes N84-15515

CIRCULATION
Prototype tidal data analysis for Mississippi Sound and adjacent areas [AD-A134071] N84-15744

CIVIL AVIATION
Helicopter noise N84-15027
Census of US Civil aircraft. Calendar year 1982 [AD-A133161] N84-15033

CLASSICAL MECHANICS
Fluid thermodynamics [ESA-TT-778] N84-15512

CLASSIFICATIONS
Screening and classification of ceramic powders [NASA-TM-77092] N84-15270
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data [E84-10068] N84-15637

CLEANERS
Elastomeric impression materials and cleaning systems for residue removal [RFP-3442] N84-15296

CLEANING
Elastomeric impression materials and cleaning systems for residue removal [RFP-3442] N84-15296

CLEARANCES
Bone blood flow measured by (41)Ar clearance formed by (44)Ca(n,(-)) (41)Ar [DE83-017600] N84-15761

CLIMATE
Pilot climate data system: A state-of-the-art capability in scientific data management [NASA-TM-85115] N84-15731
Climate-chemistry connection [DE84-001950] N84-15739
Development and perturbation analysis of model stochastic equations for global circulation N84-15743

CLIMATOLOGY
Possible tidal modulation of the Indian monsoon onset N84-15721
A comparison study of the energetics of standing and transient eddies between two general circulation models: The GLAS Climate Model and the NCAR Community Climate Model N84-15726

CLINICAL MEDICINE
Low X-ray absorption aneurism clips [NASA-CASE-LAR-12650-2] N84-15764

CLIPS
Low X-ray absorption aneurism clips [NASA-CASE-LAR-12650-2] N84-15764

CLOSED CYCLES
Gifford-McMahon refrigerator with split cold head N84-15346
Suitability of commercially available laboratory cryogenic refrigerators to support shipboard electro-optical systems in the 10 - 77 Kelvin region N84-15355

CLOSURE LAW
Introduction to turbulent shear flows N84-15449

CLOTHING
Effectiveness of two portable liquid-cooled undergarments in reducing heat stress [AD-A133174] N84-15801

CLOUD GLACIATION
Ice formation in aircraft N84-15130

CLOUD PHYSICS
Development of theoretical models and analyses of the micro-physics of cloud and precipitation systems [AD-A133557] N84-15735
Radiative-dynamic properties of Arctic stratus clouds and their possible modification by aerosol particles [DFVLR-FB-83-23] N84-15740
Investigation of the arc cloud complex N84-16029

CLOUDS (METEOROLOGY)
A diagnostic case study of the effects of deep extratropical convection on the large-scale temperature and moisture structure N84-15695
Evaluation of 2 1-D cloud models for the analysis of VAS soundings [NASA-CR-3771] N84-15729

CLUMPS
Calculation of structure factor for different cluster models of an amorphous alloy [BLL-M-35293-(5828.4)] N84-15234

CLUSTER ANALYSIS
Study of phase diagrams of ternary semiconductors [AD-A133556] N84-16000

CLUTTER
The maximum entropy method and its application to clutter cancellation N84-15890

COASTAL ZONE COLOR SCANNER
The advection of submesoscale thermal features in the Alboran Sea Gyre [AD-A133877] N84-15749

COASTS
10 cm radar ground clutter measurements taken from a coastal steamer radar on passage from Bergen to North Cape in May 1982 N84-15667

COATING
Sputtering of multicomponent materials N84-15312

COATINGS
Aerostat icing problems [AD-A133403] N84-15272

COCKPITS
Color display technology in advanced fighter cockpits N84-15061

Linguistic methodology for the analysis of aviation accidents
[NASA-CR-3741] N84-15135

CODES
Numerical experiments with CONCHAS-SPRAY: Compression stroke of an external chamber diesel engine
[DE84-002321] N84-15561
Methodology for the objective validation of model performance, with an application to atmospheric transport models
[DE83-015693] N84-15693

CODING
Vector coding the finite volume procedure for the CYBER 205 N84-15465
NASA/MSFC NASTRAN auxiliary I/O routines N84-15592

COEFFICIENTS
Generalizing the TRAPRG and TRAPAX finite elements N84-15596

COGNITIVE PSYCHOLOGY
Human visual information processing: Basic viewpoints from psychology and human engineering research
[NLR-MP-82032-U] N84-15798

COHERENT ELECTROMAGNETIC RADIATION
Coherent electromagnetic wave propagation and scattering in random media
[AD-A133601] N84-15381

COHERENT RADIATION
Coherent effects in laser spectroscopy N84-15533

COHERENT SCATTERING
Coherent electromagnetic wave propagation and scattering in random media
[AD-A133601] N84-15381

COLD PLASMAS
Thermal and electrical interaction of tantalum with a low temperature chemically active plasma flow
[NASA-TM-77374] N84-15980

COLD ROLLING
Stability of mechanical properties of cold-drawn rolled metal with high-temperature thermomechanical treatment
[BLL-M-35292-(5828.4)] N84-15233

COLD WATER
The advection of submesoscale thermal features in the Alboran Sea Gyre
[AD-A133877] N84-15749

COLLISION PARAMETERS
Use of synchrotron radiation for electron identification at high luminosity N84-15935

COLLISION RATES
Calorimetry at L = 10/sup 33 N84-15931

COLLISIONLESS PLASMAS
Nonlinear interaction of toroidicity induced drift modes
[DE84-001562] N84-15987

COLLISIONS
Scintillation chamber operation of calorimters for colliding beam detectors N84-15927
Average vibrational energy transfer during a single collision of excited molecules with heat bath molecules
[AD-A133391] N84-15949

COLOR
Color display technology in advanced fighter cockpits N84-15061
Electrically controlled coloration of materials
[AD-A133420] N84-15223
Displaying colors of specified chrominance on a color graphics display
[AD-A133591] N84-15817

COLOR VISION
Color perception and ATC job performance
[AD-A132649] N84-15781

COLORADO
A correlation analysis of percent canopy closure versus TMS spectral response for selected forest sites in the San Juan National Forest, Colorado
[E84-10066] N84-15635

COMBAT
Improved dynamic models for air combat analysis
[TAE-483] N84-15876

COMBUSTION
Combustion at the interface of an oxidizer-fuel slab system N84-15215
Atomization and mixing study
[NASA-CR-170943] N84-15284

COMBUSTION CHAMBERS
Clean catalytic combustor program
[NASA-CR-168323] N84-15151
Aerothermal modeling. Executive summary
[NASA-CR-168330] N84-15152
Aerothermal modeling, phase 1. Volume 1: Model assessment
[NASA-CR-168296-VOL-1] N84-15155
Nonlinear acoustics instabilities in combustion chambers N84-15230

COMBUSTION PHYSICS
Unconfined gas explosions --- conferences
[VKI-LS-1983-02] N84-15438
Unconfined vapor cloud explosions: A review of recent theories and experiments N84-15439
Identification of problem areas --- unconfined gas explosions N84-15440
Flat cloud modeling --- unconfined gas explosions N84-15442
Estimate of blast wave properties --- unconfined vapor cloud explosions (UVCE) N84-15443
Analytical solutions for the flow field induced by a spherical flame expanding at constant velocity N84-15445

COMBUSTION PRODUCTS
Inhalation toxicology. 3: Evaluation of thermal degradation products from aircraft and automobile engine oils, aircraft hydraulic fluid, and mineral oil
[AD-A133221] N84-15778

COMETS
Part 1: Physical studies of distant comets. Part 2: Morphologies of planetary nebulae N84-16091

COMMERCIAL AIRCRAFT
Census of US Civil aircraft. Calendar year 1982
[AD-A133161] N84-15033
The man-machine interface in new generation commercial aircraft N84-15096

COMMUNICATION
Network communications for a distributed avionics system N84-15052
Low rate transmission of video signals using adaptive delta modulation
[AD-A133145] N84-15363

COMMUNICATION CABLES
Activities report in communications research performed in cooperation with Higher Institute for Posts and Telegraph (ISPT) N84-15384

COMMUNICATION EQUIPMENT
Integration of ICNIA into advanced high performance fighter aircraft N84-15059
Computer science and technology: Future information processing technology, 1983
[PB83-257618] N84-15820

COMMUNICATION NETWORKS
Efficient utilization of the DRAMA service channel
[AD-A133286] N84-15366
Advanced teleprocessing systems
[AD-A133525] N84-15375
Advanced teleprocessing systems
[AD-A133555] N84-15378
Dynamic control of session input rates in communication networks
[AD-A133572] N84-15379
A learning approach to routing in data communication networks
[REPT-8212] N84-15834

COMMUNICATION SATELLITES
Earth coverage corrugated horns (44.5 GHz and 20.7 GHz)
[AD-A133241] N84-15366

COMPARISON
A comparison study of the energetics of standing and transient eddies between two general circulation models: The GLAS Climate Model and the NCAR Community Climate Model N84-15726
Comparison of IRT observed-score and true-score equatings
[AD-A133871] N84-15791

COMPATIBILITY
Incentives for controlling the performance of high technology and professional employees
[AD-A134074] N84-16061
The perceptual component of relationships in library networks N84-16070

COMPLEX COMPOUNDS
The chemistry of transition metal carbene complexes
[AD-A133541] N84-15225

COMPLEX VARIABLES
Elements of functions of a complex variable N84-15881

COMPONENT RELIABILITY
First level integrated maintenance in weapons systems N84-15054

COMPOSITE MATERIALS
Phosphorous-containing imide resins --- flame resistant composite materials
[NASA-CASE-ARC-11368-3] N84-15202
The preparation and properties of porous glass-polymer composite N84-15261

COMPRESSED AIR
A quasi-continuous transonic wind tunnel for cryogenic operation
[ROLLAB-MEMO-RM-096] N84-15161

COMPRESSIBLE BOUNDARY LAYER
A finite difference technique for laminar and turbulent compressible boundary layers N84-15433
Some aspects of two-dimensional compressible turbulent boundary layers N84-15456
Three-dimensional, time-dependent, compressible, turbulent, integral boundary-layer equations in general curvilinear coordinates and their numerical solution
[AD-A133289] N84-15504

COMPRESSIBLE FLOW
Computational methods for ideal compressible flow N84-15462

COMPRESSING
Plastic flows of tubes and blocks N84-15421

COMPRESSION RATIO
Numerical experiments with CONCHAS-SPRAY: Compression stroke of an external chamber diesel engine
[DE84-002321] N84-15561

COMPRESSOR BLADES
Design procedures for compressor blades
[NASA-TM-77085] N84-15552

COMPRESSORS
Bladed-shrouded-disc aeroelastic analyses: Computer program updates in NASTRAN level 17.7
[NASA-CR-165428] N84-15154
Gifford-McMahon refrigerator with split cold head N84-15346
Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space
[NASA-TM-85066] N84-15555

COMPTON EFFECT
Nonlinear interaction of toroidicity induced drift modes
[DE84-001562] N84-15987

COMPUTATION
Site-dependent inelastic response spectra N84-15620
Visual routines
[AD-A133634] N84-15792
Analysis of data flow for SIMD (Single Instruction Multiple Data) systems
[AD-A133248] N84-15812
Efficient large-scale finite-element computations in a CRAY environment
[DE83-014946] N84-15818
The generalized Euler-Mascheroni constants
[NASA-TP-2264] N84-15880

COMPUTATIONAL FLUID DYNAMICS
Computation of steady internal flows using integral representation methods with finite series expansions N84-15418
An assumed deviatoric stress-velocity-pressure mixed finite element method for unsteady convective, incompressible viscous flow N84-15420
Fully-coupled analysis of jet mixing problems. Part 1. Shock-capturing model, SCIPVIS
[NASA-CR-3761] N84-15425
Introduction to computational fluid dynamics --- conferences
[VKI-LS-1983-01] N84-15429
Equations of fluid flow, finite difference approximations and basic mathematical properties of each N84-15430
An introduction to numerical methods suitable for the Euler equations N84-15431
Finite difference methods for convective-diffusive equations N84-15432
Three-dimensional wake of a swept wing N84-15458
Computational Fluid Dynamics, volume 1 --- conferences
[VKI-LS-1983-04-VOL-1] N84-15461
Computational methods for ideal compressible flow N84-15462
Higher order approximations in fluid mechanisms: Compact to spectral N84-15466
Computational Fluid Dynamics, volume 2 --- conferences
[VKI-LS-1983-04-VOL-2] N84-15467
Least squares and domain decomposition methods applied to the numerical solution of nonlinear problems in fluid dynamics N84-15468
Numerical computation of transonic flow governed by the full-potential equation N84-15469
Three-dimensional flow calculations on a hypothetical steam turbine last stage N84-15481
Wet steam flow in L. P. turbines --- low pressure (LP) N84-15483
Fully coupled calculation of fluid flows with limited use of computer storage
[DE84-002218] N84-15508
A local-relaxation method for solving convection-diffusion equations
[NLR-MP-82030-U] N84-15862
A numerical investigation of the multiple vortex phenomenon: Vortex number and structure as a function of swirl ratio N84-16049

COMPUTATIONAL GRIDS
Numerical modeling and fast-solver calculation of approximately normal shocks
[NLR-MP-82026-U] N84-15856

COMPUTER AIDED DESIGN
Towards a modularity of software conceived for the requirement of the user N84-15040
Computer graphics techniques for aircraft EMC analysis and design N84-15055
CASCADE: A design environment for future avionic systems N84-15057
CADAS: A computer aided design tool for avionic systems N84-15065
Thermal analysis research applicable to space station technology needs
[NASA-TM-84658] N84-15426
Application of interactive computer graphics in finite element analysis N84-15575
Computer-Aided Structural Engineering (CASE) project. User's guide: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133600] N84-15611
The 2nd European Conference on Computer Aided Design in Smalland Medium-Size Industries
[AD-A129369] N84-15821
Computer-Aided Structural Engineering (CASE) project. Reference manual: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133493] N84-15828
Off-line graphics processing: A case study
[DE84-002420] N84-15832

COMPUTER AIDED MANUFACTURING
The 2nd European Conference on Computer Aided Design in Smalland Medium-Size Industries
[AD-A129369] N84-15821
Off-line graphics processing: A case study
[DE84-002420] N84-15832

COMPUTER ASSISTED INSTRUCTION
A comparison of map learning methods: Map study, simulated travel and mixed
[AD-A133544] N84-15794
Computer based landing signal officer carrier aircraft recovery model
[AD-A133507] N84-15808
Classifying bugs is a tricky business
[AD-A133264] N84-15813
Tailored testing theory and practice: A basic model, normal ogive submodels, and tailored testing algorithms
[AD-A133385] N84-15824
A guideline for the planning and system requirement determination of a computer based educational system
[AD-A133529] N84-15829
Artificial intelligence: An analysis of potential applications to training, performance measurement, and job performance aiding
[AD-A133592] N84-15839

COMPUTER GRAPHICS
Avionics concept evaluation at the force level N84-15038
Computer graphics techniques for aircraft EMC analysis and design N84-15055
Application of interactive computer graphics in finite element analysis N84-15575
The GPRIME approach to finite element modeling N84-15594
Computer-Aided Structural Engineering (CASE) project. User's guide: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133600] N84-15611
Evaluation of map symbols for a computer generated topographic display: Transfer of training, symbol confusion, and association value studies
[AD-A133590] N84-15643
Displaying colors of specified chrominance on a color graphics display
[AD-A133591] N84-15817
Computer-Aided Structural Engineering (CASE) project. Reference manual: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133493] N84-15828
Use of 3D graphics in scientific data analysis
[DE84-000911] N84-15831
Off-line graphics processing: A case study
[DE84-002420] N84-15832
Computer-Output Microfiche (COM) on the Oak Ridge computer network
[DE84-002422] N84-15836

COMPUTER NETWORKS
Advanced automation program. Program master plan
[DOT/FAA/AP-83/3] N84-15139
A learning approach to routing in data communication networks
[REPT-8212] N84-15834
Computer-Output Microfiche (COM) on the Oak Ridge computer network
[DE84-002422] N84-15836
Rivista Tecnica Selenia, volume 8, number 3, 1983 N84-15887
Local area networks: Impact on shipboard applications N84-15888
Research topics in statistical database management
[DE84-002581] N84-16080

COMPUTER PROGRAMMING
Nonlinear inverse perturbation method in dynamic redesign N84-15107
Vector coding the finite volume procedure for the CYBER 205 N84-15465
Development of theoretical models and analyses of the micro-physics of cloud and precipitation systems
[AD-A133557] N84-15735
Classifying bugs is a tricky business
[AD-A133264] N84-15813
Efficient demand-driven evaluation
[AD-A133477] N84-15827

COMPUTER PROGRAMS
CADAS: A computer aided design tool for avionic systems N84-15065
Automating the testing of software N84-15074
A dynamic approach to military avionics systems testing N84-15075
TAS: A Transonic Aircraft/Store flow field prediction code
[NASA-CR-3721] N84-15114
Advanced automation program. Program master plan
[DOT/FAA/AP-83/3] N84-15139
Aerothermal modeling. Executive summary
[NASA-CR-168330] N84-15152
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169
Heat capacity and thermodynamic properties of linear macromolecules N84-15263
Nonlinear viscoelastic characterization of structural adhesives
[NASA-CR-172279] N84-15268
LARC: Computer codes for Lagrangian analysis of stress-guage data to obtain decomposition rates through correlation to thermodynamic variables
[DE84-002404] N84-15292
Computer program for analysis of split-Stirling-cycle cryogenic coolers N84-15344
Fully-coupled analysis of jet mixing problems. Part 1. Shock-capturing model, SCIPVIS
[NASA-CR-3761] N84-15425
Numerical solution to the steady state equation of transfer in azimuthally symmetric geometries --- heat transfer and molecular flow
[DE84-001781] N84-15509
Eleventh NASTRAN User's Colloquium
[NASA-CP-2284] N84-15590
BANDIT in NASTRAN N84-15591
NASA/MSFC NASTRAN auxiliary I/O routines N84-15592
Using PAFEC as a preprocessor for COSMIC/NASTRAN N84-15593
The GPRIME approach to finite element modeling N84-15594
Generalizing the TRAPRG and TRAPAX finite elements N84-15596
An alternative method of analysis for base accelerated dynamic response in NASTRAN N84-15598
A NASTRAN DMAP procedure for calculation of base excitation modal participation factors N84-15599
Computer-Aided Structural Engineering (CASE) project. User's guide: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133600] N84-15611
Determination of propagation limitations at HF by real-time update of a computer model from oblique sounder data N84-15660
Elliptic solvers for NORDA ocean models and a quasi-geostrophic regional eddy-mean energetics package
[AD-A133754] N84-15751
Computer science and technology: Future information processing technology, 1983
[PB83-257618] N84-15820
Development of an interactive computer program to produce body description data
[AD-A133720] N84-15822
Report and recommendations for improving constitutive relations used in computer codes --- shock mechanics in solids
[AD-A133239] N84-15823
PROUST: Knowledge-based program understanding
[AD-A133447] N84-15825
Sparse Matrix Software Catalog
[AD-A133559] N84-15830
Introduction to the FORTRAN 14 programs Duvorol and Contact for the solution of 3 D elastostatic half-space contact problems with and without friction
[PB83-147421] N84-15833
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics
[AD-A133142] N84-15843
A new numerical method for the transient gas-dyanmic code EVENT
[LA-9594-MS] N84-15977
Studies of neutron and proton nuclear activation in low-Earth orbit 2 N84-16041
Perspectives on oversight management of software development projects
[AD-A133404] N84-16064
FGGE/SMMR-30 tape specification and shipping letter description
[NASA-CR-170550] N84-16074
Local automation model: Functional description
[AD-A133389] N84-16077

COMPUTER STORAGE DEVICES
Recording and reproduction of microwave holograms using a scanning procedure and their subsequent optical processing
[NASA-TM-77349] N84-15519

COMPUTER SYSTEMS DESIGN
Software testing of safety critical systems N84-15073
Automating the testing of software N84-15074
Numerical experiments with CONCHAS-SPRAY: Compression stroke of an external chamber diesel engine
[DE84-002321] N84-15561
Mie code AGAUS 82
[AD-A133489] N84-15964

COMPUTER SYSTEMS PROGRAMS
A method of calculating fully three dimensional inviscid flow through any type of turbomachine blade row N84-15479
The BLOW-3A: A theoretical model to describe transient two phase flow conditions in Liquid Metal Fast Breeder Reactor (LMFBR) coolant channels N84-15497
Multispectral Data Processing System (MDPS)
[AD-A133426] N84-15816
A multipurpose production controller for plasma physics codes
[LA-9477-MS] N84-15978

COMPUTER TECHNIQUES
Loads and aeroelasticity division research and technology accomplishments for FY 1982 and plans for FY 1983
[NASA-TM-84594] N84-15120
In situ characterization of seawater using a computerized suite of optical instruments N84-15675
Methodology for the objective validation of model performance, with an application to atmospheric transport models
[DE83-015693] N84-15693
A distributed control system for the CMU Rover
[AD-A133201] N84-15802
Status of research at the Institute for Computer Applications in Science and Engineering (ICASE)
[NASA-CR-172267] N84-15811
Techniques for sensor-based diagnosis
[AD-A133297] N84-15814
A modular twin bus microprocessor system for laboratory automation
[AD-A133372] N84-15815
Efficient demand-driven evaluation
[AD-A133477] N84-15827
Computer-Output Microfiche (COM) on the Oak Ridge computer network
[DE84-002422] N84-15836

COMPUTER VISION
Automatic inspection for printed wiring
[AD-A133328] N84-15566
Image understanding research and its application to cartography and computer-based analysis of aerial imagery
[AD-A133495] N84-15642
POPEYE: A gray-level vision system for robotics applications
[AD-A133298] N84-15804
Implementation of automatic focusing algorithms for a computer vision system with camera control
[AD-A133492] N84-15807
A representation for shape based on peaks and ridges in the difference of low-pass transform
[AD-A133299] N84-15849
Sensor control of robot arc welding N84-16047

COMPUTERIZED SIMULATION
Computer aided construction of ground attack mission profiles over European terrain N84-15060
A computer model for an imaging coherent laser radar
[FOA-C-30341-E] N84-15388
Recent advances in variable speed electrical generator systems for large wind turbines
[DE84-001633] N84-15404
The BLOW-3A: A theoretical model to describe transient two phase flow conditions in Liquid Metal Fast Breeder Reactor (LMFBR) coolant channels N84-15497

Theoretical simulation of thermohydraulic behavior of sodium cooled subassemblies in steady state and transient conditions — liquid metal fast breeder reactors (LMFBR) N84-15498

Computation of the thermohydraulics in subassemblies for accident situations — liquid metal fast breeder reactors (LMFBR) N84-15499

Assessment of load-frequency-control impacts caused by small wind turbines [DE82-011513] N84-15677

Some effects of surface heating and topography on the regional severe storm environment N84-15723

A numerical investigation of the formation of secondary vortices in laboratory-simulated tornadoes N84-15725

A comparison of map learning methods: Map study, simulated travel and mixed [AD-A133544] N84-15794

Development of an interactive computer program to produce body description data [AD-A133720] N84-15822

On the fitting of Pearson curves to sums of independent random variables [AD-A133153] N84-15844

Fabrication and properties of multilayer structures [NASA-CR-174506] N84-15997

Logic simulator program N84-16023

ISIS: A constraint-directed reasoning approach to job shop scheduling [AD-A133296] N84-16063

CONCENTRATION (COMPOSITION)

Influence of alloying on the properties of nickel in the solid and liquid states [BLL-M-35284-(5828.4)] N84-15232

Methodology for the objective validation of model performance, with an application to atmospheric transport models [DE83-015693] N84-15693

Climate-chemistry connection [DE84-001950] N84-15739

Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States [AD-A133150] N84-15777

Partial analysis of Insta-Foam N84-16030

CONCENTRATORS

Development of a consensus standard for determining thermal performance of high-concentration-ratio solar collectors [DE83-005129] N84-15676

CONCENTRICITY

Vibration-induced flux variation in the space between two concentric tubes [BLL-CE-TRANS-7949-(9022.09)] N84-15583

CONCRETES

Abrasion-erosion resistance of concrete made with two aggregates, Stonewall Jackson Dam, West Virginia [AD-A133432] N84-15357

A three-dimensional photoelastic investigation of stresses and cracks formed in concrete around deformed reinforcing bars N84-15621

CONDENSERS (LIQUEFIERS)

Aerothermodynamics of Low Pressure Steam Turbines and Condensers, volume 1 — conferences [VKI-LS-1983-06-VOL-1] N84-15472

Aerothermodynamics of Low Pressure Steam Turbines and Condensers, Volume 2 — conferences [VKI-LS-1983-06-VOL-2] N84-15482

Steam condenser thermal design theories N84-15485

Steam condenser developments N84-15486

CONDENSING

Two dimensional condensing flow in transonic turbine cascades N84-15484

CONFERENCES

Aeroacoustics: Ten Years of Research — conferences [VKI-LS-1983-05] N84-15025

Detroit space odessey [NASA-TM-85487] N84-15164

Energy Materials Coordinating Committee (EMACC). Contractors Meeting on Problems and Opportunities in Structural Ceramics [CONF-8209111] N84-15266

Proceedings of Symposium on Surface Science and its Industrial Implications [ISBN-0-7988-2417-4] N84-15298

Refrigeration for Cryogenic Sensors [NASA-CP-2287] N84-15327

Introduction to computational fluid dynamics — conferences [VKI-LS-1983-01] N84-15429

Unconfined gas explosions — conferences [VKI-LS-1983-02] N84-15438

Turbulent shear flows — conferences [VKI-LS-1983-03] N84-15448

Computational Fluid Dynamics, volume 1 — conferences [VKI-LS-1983-04-VOL-1] N84-15461

Computational Fluid Dynamics, volume 2 — conferences [VKI-LS-1983-04-VOL-2] N84-15467

Aerothermodynamics of Low Pressure Steam Turbines and Condensers, volume 1 — conferences [VKI-LS-1983-06-VOL-1] N84-15472

Aerothermodynamics of Low Pressure Steam Turbines and Condensers, Volume 2 — conferences [VKI-LS-1983-06-VOL-2] N84-15482

Thermohydraulics of liquid metals, volume 1 — conferences [VKI-LS-1983-07-VOL-1] N84-15487

Thermohydraulics of liquid metals, volume 2 — conferences [VKI-LS-1983-07-VOL-2] N84-15494

Eleventh NASTRAN User's Colloquium [NASA-CP-2284] N84-15590

Propagation Factors Affecting Remote Sensing by Radio Waves [AGARD-CP-345] N84-15646

Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States [AD-A133150] N84-15777

The 2nd European Conference on Computer Aided Design in Smalland Medium-Size Industries [AD-A129389] N84-15821

Sparse Matrix Software Catalog [AD-A133559] N84-15830

Proceedings of the 1983 DPF Workshop on Collider Detectors: Present Capacities and Future Possibilities [LBL-15973] N84-15911

Cleveland Space Odyssey [NASA-TM-85493] N84-16020

Chicago Meets Outer Space program [NASA-TM-85492] N84-16021

CONFIGURATION INTERACTION

Electron-electron interactions and broken symmetry in one dimension [DE84-001704] N84-16014

CONICAL FLOW

A wing concept for supersonic maneuvering [NASA-CR-3763] N84-15115

CONNECTORS

Fabrication of a hermetically sealed connector [DE84-002322] N84-15402

CONSTANTS

The generalized Euler-Mascheroni constants [NASA-TP-2264] N84-15880

The generalized Euler-Mascheroni constants N84-16024

CONSTITUTIVE EQUATIONS

Stiffness changes in unidirectional composites caused by crack systems [CA-8311] N84-15198

Finite elemont analysis of moisture and external loading effects in composites N84-15211

Propellant nonlinear constitutive theory extension: Preliminary results [AD-A133364] N84-15287

CONSTRAINTS

Exploiting temporal knowledge to organize constraints [AD-A133417] N84-15838

Constrained function minimization. Comparison of the augmented Lagrangian and sequentially increasing penalty method [PB83-217265] N84-15863

CONSTRUCTION

Measures against errors in the building process [NRC/CNR-TT-2067] N84-15295

CONTINUITY EQUATION

A survey of solution techniques for nonlinear finite element equations [NLR-MP-82027-U] N84-15861

CONTINUOUS WAVE RADAR

A FMCW radar ranging device for the teleoperator maneuvering system N84-16045

CONTOURS

Edge- and contour detection for correction of low-pass filtered images [PB83-217489] N84-15969

CONTROL

Incentives for controlling the performance of high technology and professional employees [AD-A134074] N84-16061

CONTROL RODS

Studies on sodium boiling phenomena in out of pile rod bundles for various accidental situations in Liquid Metal Fast Breeder Reactors (LMFBR) experiments and interpretations N84-15493

CONTROL SURFACES

A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies [AD-A133399] N84-15169

CONTROL THEORY

AFTI/F-16 flight test results and lessons [NASA-TM-84920] N84-15159

CONTROLLABILITY

Sensor control of robot arc welding N84-16047

CONTROLLED ATMOSPHERES

Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States [AD-A133150] N84-15777

CONTROLLED FUSION

Radiation effects in the Joint European Torus Experiment: Guidelines for preliminary design [R857/2] N84-15971

CONVECTION

Comparison of steady state transitions in truncated spectral and finite difference models of two-dimensional shallow convection N84-15417

Studies in unsteady penetrative thermal convection N84-15422

A diagnostic case study of the effects of deep extratropical convection on the large-scale temperature and moisture structure N84-15695

Numerical simulations of convectively excited gravity waves [DE84-001867] N84-15718

Investigation of the arc cloud complex N84-16029

CONVECTIVE FLOW

An assumed deviatoric stress-velocity-pressure mixed finite element method for unsteady convective, incompressible viscous flow N84-15420

Studies in unsteady penetrative thermal convection N84-15422

Finite difference methods for convective-diffusive equations N84-15432

The accuracy of the finite difference computations of recirculating free convective flows N84-15471

CONVECTIVE HEAT TRANSFER

Experimental mixed convection heat transfer from a large vertical surface in a horizontal flow N84-15412

Steam condenser thermal design theories N84-15485

Thermohydraulics in liquid metals N84-15491

CONVERGENCE

Relationships between thunderstorm mesoscale circulation and tornadogenesis N84-15727

CONVERGENT NOZZLES

Shock associated noise — nozzles N84-15030

CONVERSATION

Linguistic methodology for the analysis of aviation accidents [NASA-CR-3741] N84-15135

CONVOLUTION INTEGRALS

Linear prediction methods — signal processing [FUB-52-1982] N84-15858

COOLANTS

Theoretical simulation of thermohydraulic behavior of sodium cooled subassemblies in steady state and transient conditions — liquid metal fast breeder reactors (LMFBR) N84-15498

COOLERS

Split-Stirling, linear-resonant, cryogenic refrigerators for detector cooling N84-15342

Split-Stirling-cycle displacer linear-electric drive N84-15343

Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space [NASA-TM-85066] N84-15555

COOLING

Aerothermal modeling. Executive summary [NASA-CR-168330] N84-15152

The effects of dehydration on peripheral cooling [AD-A130838] N84-15767

COOLING SYSTEMS

Evaluation of air-cooled central receivers [DE83-005130] N84-15423

The BLOW-3A: A theoretical model to describe transient two phase flow conditions in Liquid Metal Fast Breeder Reactor (LMFBR) coolant channels N84-15497

Investigation of a para-ortho hydrogen reactor for application to spacecraft sensor cooling [NASA-CR-175131] N84-15957

COORDINATE TRANSFORMATIONS

Practical three-dimensional mesh generation using transfinite interpolation N84-15463

COORDINATES

Three-dimensional, time-dependent, compressible, turbulent, integral boundary-layer equations in general curvilinear coordinates and their numerical solution [AD-A133289] N84-15504

COPOLYMERS
Aerostat icing problems
[AD-A133403] N84-15272
COPPER
Surface coating systems for copper and copper alloys N84-15311
A formula for the sputtering yield of polycrystalline materials N84-15313
Copper vapor laser scale demonstration
[AD-A133327] N84-15543
COPPER ALLOYS
Surface coating systems for copper and copper alloys N84-15311
CORE FLOW
The core region of channel flows N84-15452
CORRELATION
Influence of alloying on the properties of nickel in the solid and liquid states
[BLL-M-35284-(5828.4)] N84-15232
Pacific Northwest solar radiation data
[DE84-002335] N84-15738
Comparison of IRT observed-score and true-score equatings
[AD-A133671] N84-15791
Some properties of a 5-parameter bivariate probability distribution
[NASA-TM-82550] N84-15866
CORROSION
Activities of the National Chemical Research Laboratory
[CSIR-SR-CHEM-261] N84-15188
Corrosion research N84-15191
Corrosion of TIG welded austenitic stainless steels
[BLL-WINDSCALE-TR-959-(9091.F)] N84-15235
Ion plating in corrosion protection
[DE84-001182] N84-15256
The role of microorganisms in marine corrosion processes
[AD-A133113] N84-15757
CORROSION PREVENTION
Preliminary investigation of ceramic-coated anodes for cathodic protection
[AD-A133440] N84-15273
The use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition N84-15307
CORROSION RESISTANCE
Methods in competition with electroplating
[BLL-OA-TRANS-3037-(6196.3)] N84-15213
Ion plating in corrosion protection
[DE84-001182] N84-15256
Pit initiation resistance of ferritic stainless steels in chloride environments from 500 to 2600C
[DE84-000355] N84-15258
Evaluation of the pitting corrosion resistance of a Fe-12% Cr alloy N84-15321
COSMIC RAYS
Calculation of cosmic ray induced single event upsets: Program CRUP (Cosmic Ray Upset Program)
[AD-A133620] N84-16113
COST ANALYSIS
A future system design technique based on functional decomposition, supported by quantifiable design aims, and guidelines for minimum maintenance costs N84-15039
COST EFFECTIVENESS
A future system design technique based on functional decomposition, supported by quantifiable design aims, and guidelines for minimum maintenance costs N84-15039
Design, development and flight test of a demonstration advanced avionics system N84-15067
COST ESTIMATES
Line-focusing adjustable parabolic splar-concentrating collector
[DE84-001590] N84-15687
COSTS
Local automation model: Functional description
[AD-A133389] N84-16077
COUPLING
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
CRACK INITIATION
Fracture behavior of unidirectional boron/aluminum composite laminates
[NASA-CR-3753] N84-15196
Comparison of fracture-toughness measurements from ferritic-steel compact-tension and surface-flawed specimen
[DE84-000895] N84-15240
Embrittlement of steels due to galvanizing or coating with zinc paint: An investigation of embrittlement in welding or heating operations --- liquid metal embrittlement
[AERE-TR-4774] N84-15244
Investigations on the reproducibility of the results of drop weight tests by the method of W. S. Pellini
[BLL-DRIC-T-6970-(3623.66)] N84-15517
CRACK PROPAGATION
Strength theories of continuous and discontinuous fiber composites N84-15195
Investigation of fatigue crack-growth resistance of aluminum alloys under spectrum loading
[AD-A133206] N84-15251
Fatigue crack propagation in Al-alloy lugs under constant amplitude and maneuver spectrum loading
[TAE-497] N84-15585
Miniature center-cracked-tension specimen for fatigue crack growth testing
[DE84-001470] N84-15615
Brief note of the stress intensity factor of elliptical cracks
[PB83-216911] N84-15618
Investigation of static and dynamic fracture of orthotropic media by photomechanics N84-15625
CRACK TIPS
Investigation of static and dynamic fracture of orthotropic media by photomechanics N84-15625
CRACKING (FRACTURING)
Complete sample analysis by gas chromatography
[BLL-T6213/BG/LRS/LRST671/83] N84-15212
A three-dimensional photoelastic investigation of stresses and cracks formed in concrete around deformed reinforcing bars N84-15621
CRACKS
Stiffness changes in unidirectional composites caused by crack systems
[CA-8311] N84-15198
CRASHWORTHINESS
Army helicopter crashworthiness N84-15090
CRAY COMPUTERS
Efficient large-scale finite-element computations in a CRAY environment
[DE83-014946] N84-15818
CREATIVITY
Organizational outcomes of creativity
[AD-A132825] N84-16066
CREEP ANALYSIS
Tensile and compressive constitutive response of 316 stainless steel at elevated temperatures
[NASA-TM-83506] N84-15249
CREEP PROPERTIES
Tensile and compressive constitutive response of 316 stainless steel at elevated temperatures
[NASA-TM-83506] N84-15249
CREEP TESTS
Grain boundary segregation and cavity formation in creep embrittled Cr-Mo steels N84-15320
CROP INVENTORIES
Development of visible/infrared/microwave agriculture classification and biomass estimation algorithms, volume 2 --- Oklahoma and Texas
[E84-10059] N84-15629
CROSS SECTIONS
Discharge cell for optogalvanic spectroscopy having orthogonal relationship between the probe laser and discharge axis
[NASA-CASE-NPO-16271-1] N84-15537
CROSSTALK
Bidirectional fiber optic cable adapter
[AD-A133371] N84-15370
CRUSTAL FRACTURES
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields --- California and Pennsylvania
[E84-10057] N84-15628
Wave propagation in porous rock and models for crustal structure N84-15698
Seismic properties of the crust and uppermost mantle of North America
[NASA-CR-175134] N84-15708
CRYOGENIC COOLING
Propulsion apparatus and method using boil-off gas from a cryogenic liquid --- controlling spacecraft attitude and drag
[NASA-CASE-MFS-25946-1] N84-15183
Refrigeration for Cryogenic Sensors
[NASA-CP-2287] N84-15327
US Navy program in small cryocoolers N84-15328
NASA needs and trends in cryogenic cooling N84-15329
Japanese activities in refrigeration technology N84-15330
Spacecraft-borne long life cryogenic refrigeration: Status and trends N84-15331
Regeneration experiments below 10K in a regenerative-cycle cryocooler N84-15332
A cryocooler for applications requiring low magnetic and mechanical interference N84-15333
An approach to optimization of low-power Stirling cryocoolers N84-15334
Regeneration efficiency, shuttle heat loss and thermal conductivity in epoxy-composite annular gap regenerators from 4K to 80K N84-15335
A 10 deg K triple-expansion Stirling-cycle cryocooler N84-15336
Gifford-McMahon refrigerator with split cold head N84-15346
Optimal design of gas adsorption refrigerators for cryogenic cooling N84-15348
A general computer model for predicting the performance of gas sorption refrigerators N84-15349
LaNi5 hydride cryogenic refrigerator test results N84-15350
4.0 K cryocooler project
[DE84-000332] N84-15358
Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space
[NASA-TM-85066] N84-15555
CRYOGENIC EQUIPMENT
Gifford-McMahon refrigerator with split cold head N84-15346
Suitability of commercially available laboratory cryogenic refrigerators to support shipboard electro-optical systems in the 10 - 77 Kelvin region N84-15355
Low cost microminiature refrigerators for large unit volume applications N84-15356
CRYOGENIC FLUID STORAGE
Testing and characterizations of infrared sensor over the temperature range of 2 Kelvin to 300 Kelvin N84-15347
CRYOGENIC MAGNETS
Utilization of low temperatures in electrical machines
[AD-A133325] N84-15399
CRYOGENIC WIND TUNNELS
A quasi-continuous transonic wind tunnel for cryogenic operation
[ROLLAB-MEMO-RM-096] N84-15161
CRYOGENICS
A miniature tilting pad gas lubricated bearing N84-15340
Life test performance of a Philips rhombic-drive refrigerator with bellows seals N84-15341
Split-Stirling, linear-resonant, cryogenic refrigerators for detector cooling N84-15342
Computer program for analysis of split-Stirling-cycle cryogenic coolers N84-15344
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
Testing and characterizations of infrared sensor over the temperature range of 2 Kelvin to 300 Kelvin N84-15347
A helium-3 refrigerator employing capillary confinement of liquid cryogen N84-15353
Cascade Joule-Thomson refrigerators N84-15354
A report on superfluid helium flow through porous plugs for space science applications N84-16043
CRYOSTATS
On 3He bolometer systems
[NASA-CR-175325] N84-15520
CRYSTAL DISLOCATIONS
Etching of defects on crystal surfaces N84-15300
CRYSTAL GROWTH
Growth processes of snow
[AD-A133136] N84-15639
Replicated CdTe substrates
[AD-A133114] N84-15994
Manufacturing technology for high quality swept-culture growth quartz
[AD-A133500] N84-15998
CRYSTAL LATTICES
The heterogeneous nucleation of ice I N84-15325
Raman measurements of the mobile cation vibrations in Na, K, Ag and Li (ALPHA)'-alumina
[DE83-015897] N84-16005
CRYSTAL STRUCTURE
Kinematics of the structure and morphology during surface reactions between transition metals and molecular hydrogen N84-15317
Structural properties of epitaxial single layer metals on (110) B.C.C. metal substrates N84-15326
Determination of ionization rates in the principal crystallographic directions in silicon
[AD-A133513] N84-15999
Structural studies at elevated pressure and reduced temperatures using synchrotron radiation: Application to Ce.8La.1Th.1
[DE84-001793] N84-16007
CRYSTAL SURFACES
Oxygen adsorption and initial oxidation of single crystal first row transition metal and alloy surfaces N84-15316
CRYSTALLINITY
Heat capacity and thermodynamic properties of linear macromolecules N84-15263

CRYSTALLITES
Trichite growth during oxidation of titanium and TA6V4 alloy by water vapor at high temperatures
[NASA-TM-76974] N84-15248
CRYSTALLIZATION
Compositional segregation in unidirectionally solidified solid solution crystals N84-16055
CRYSTALLOGRAPHY
Surface segration and diffusion investigations by means of AES N84-15319
Diffraction techniques
[AD-A133254] N84-15944
CRYSTALS
Compositional segregation in unidirectionally solidified solid solution crystals N84-16055
CULTURE TECHNIQUES
Manufacturing technology for high quality swept-culture growth quartz
[AD-A133500] N84-15998
CURIE TEMPERATURE
The theory of an active magnetic regenerative refrigerator N84-15351
CURRENT DENSITY
Extraction of volume produced H(-) or D(-) ions from a sheet plasma I
[IPPJ-645] N84-15974
Superconducting properties of Nb3Sn multifilamentary wires fabricated by internal tin process
[DE83-018189] N84-16011
CURRENT DISTRIBUTION
Computations of the current profile influence on tearing instability
[NASA-TM-77285] N84-15981
CURVATURE
An integrated system for shells with discontinuities: Geometric modelling and finite element analysis N84-15576
Experimental designs for quantal response models
[AD-A133416] N84-15851
CURVE FITTING
On the fitting of Pearson curves to sums of independent random variables
[AD-A133153] N84-15844
CYCLIC LOADS
The effect of superposing ripple loading of maneuver load cycles
[AD-A132653] N84-15148
Fatigue damage-strength relationships in composite laminates. Volume 1
[AD-A133485] N84-15206
CYCLOGENESIS
A comparison of NMC models (1977) on precipitation forecasts for east coast cyclogenesis N84-15720
CYCLONES
Ocean temperature changes induced by tropical cyclones N84-15722
CYGNUS CONSTELLATION
Periodic spectral variation in Cygnus X-2 and Scorpius X-1 N84-16088
CYLINDRICAL BODIES
The effects of space charge on ionic mobility measurements in cylindrical geometries N84-15993
CYLINDRICAL SHELLS
An experimental investigation of the boundary layer structures in a partially-filled horizontal and rapidly-rotating cylinder N84-15414
Liquid management in low gravity using baffled rotating containers
[NASA-TP-2263] N84-15427
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602
Stiffness properties for dynamic modeling of composite graphite-epoxy cylindrical orthotropic shells N84-16054

D

DAMAGE
Further abbreviation of the machining schedule for producing surface-damage-free beryllium
[DOE/TIC-4500-REV-69] N84-15297
General method for fatigue analysis of vertical axis wind turbine blades
[DE84-002654] N84-15613
DAMPING
Multishaker modal testing
[NASA-CR-170952] N84-15521
DAMS
Abrasion-erosion resistance of concrete made with two aggregates, Stonewall Jackson Dam, West Virginia
[AD-A133432] N84-15357
DATA ACQUISITION
Incident reporting: Its role in aviation safety and the acquisition of human error data N84-15081
The analysis of records of parameters: An indispensable tool in oversight and in operations control N84-15082
IRIG standard for distributing interrange vector acquisition data
[AD-A133617] N84-15170
Support for the Naval Research Laboratory Environmental Passive Microwave Remote Sensing Program
[AD-A133330] N84-15526
Techniques for sensor-based diagnosis
[AD-A133297] N84-15814
Laboratory automation of a quadrupole mass spectrometer N84-16053
The perceptual component of relationships in library networks N84-16070
DATA BASE MANAGEMENT SYSTEMS
Using PAFEC as a preprocessor for COSMIC/NASTRAN N84-15593
FGGE/SMMR-30 tape specification and shipping letter description
[NASA-CR-170550] N84-16074
Local automation model: Functional description
[AD-A133389] N84-16077
Research topics in statistical database management
[DE84-002581] N84-16080
Processing time using Datatrieve-11, clunks, and FORTRAN
[DE84-001706] N84-16081
Joint Atomic Information Exchange Group information management project. Briefing outlining functions and specifications of JAIEG automated information management system
[DE84-001800] N84-16082
DATA BASES
A new method for generating and maintaining rigid formats in NASTRAN N84-15605
USAF advanced terrestrial energy study. Volume 3: Parameter survey
[AD-A133501] N84-15685
USAF advanced terrestrial energy study. Volume 4: Analysis, data, and bibliography
[AD-A133514] N84-15686
Development of generic mobility-terrain data bases: Investigation of critical soil parameters
[AD-A133595] N84-15715
A new treatment of incomplete information and retrieval in relational data bases N84-16069
An interactive soils information system. Users manual
[AD-A133480] N84-16078
DATA FLOW ANALYSIS
Analysis of data flow for SIMD (Single Instruction Multiple Data) systems
[AD-A133248] N84-15812
DATA LINKS
Bidirectional fiber optic cable adapter
[AD-A133371] N84-15370
DATA MANAGEMENT
Pilot climate data system: A state-of-the-art capability in scientific data management
[NASA-TM-85115] N84-15731
Perspectives on oversight management of software development projects
[AD-A133404] N84-16064
FGGE/SBUV tape specification and shipping letter description
[NASA-CR-170482] N84-16071
FGGE/ERBM tape specification and shipping letter description
[NASA-CR-170547] N84-16072
FGGE/ERBZ tape specification and shipping letter description
[NASA-CR-170548] N84-16073
DATA PROCESSING
A dynamic approach to military avionics systems testing N84-15075
IRIG standard for distributing interrange vector acquisition data
[AD-A133617] N84-15170
BANDIT in NASTRAN N84-15591
Effective use of earthquake data
[AD-A134077] N84-15712
Use of 3D graphics in scientific data analysis
[DE84-000911] N84-15831
Laboratory automation of a quadrupole mass spectrometer N84-16053
Local automation model: Functional description
[AD-A133389] N84-16077
DATA RECORDING
Flight parameters recording for safety monitoring and investigations N84-15083
Recording and reproduction of microwave holograms using a scanning procedure and their subsequent optical processing
[NASA-TM-77349] N84-15519
DATA REDUCTION
Mission definition study for a VLBI station utilizing the Space Shuttle
[NASA-CR-175126] N84-15173
Investigation of antarctic crust and upper mantle using MAGSAT and other geophysical data
[E84-10055] N84-15627
Uranium anomalies in Wyoming and parts of adjacent states. National Uranium Resource Evaluation
[DE83-005353] N84-15636
Data analysis and theoretical studies for atmospheric Explorer C, D and E
[NASA-CR-175121] N84-15711
Pacific Northwest solar radiation data
[DE84-002335] N84-15738
DATA RETRIEVAL
NASA/MSFC NASTRAN auxiliary I/O routines N84-15592
DATA TRANSMISSION
DEF STAN 00-18: A family of compatible digital interface standards N84-15049
Techniques for interbus communication in a multibus avionic system N84-15050
Network communications for a distributed avionics system N84-15052
Spread spectrum transmission. Part 1: General characteristics
[FUB-49-1982-PT-1] N84-15385
DEACTIVATION
Interactions of vibrationally excited molecules with solid surfaces
[AD-A133449] N84-15950
DEBRIS
FOD (Foreign Object Damage) generation by aircraft tires — probability of engine ingestion and airfield surface movements
[AD-A133319] N84-15146
Thermohydraulics of LMFBR core catchers — liquid metal fast breeder reactors (LMFBR) N84-15500
DECAMETRIC WAVES
Contending with jamming in decametric waves in an adaptive system of all-directional antennas N84-15653
DECELERATION
Improved four-stage accel-decel production of low-energy stripped heavy ions
[DE83-005791] N84-15908
DECISION MAKING
Human visual information processing: Basic viewpoints from psychology and human engineering research
[NLR-MP-82032-U] N84-15798
Computer based landing signal officer carrier aircraft recovery model
[AD-A133507] N84-15808
Ambiguity and uncertainty in probabilistic inference
[AD-A133418] N84-15872
Perspectives on oversight management of software development projects
[AD-A133404] N84-16064
DECOMPOSITION
Least squares and domain decomposition methods applied to the numerical solution of nonlinear problems in fluid dynamics N84-15468
DECOMPRESSION SICKNESS
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
DEFECTS
Comparison of fracture-toughness measurements from ferritic-steel compact-tension and surface-flawed specimen
[DE84-000895] N84-15240
Moment estimators of defect pattern frequencies, allowing for inspection error
[AD-A133487] N84-15568
Ultrasonic test data acquisition and defect verification of stainless steel welds at 4000 deg F
[DE83-012146] N84-15570
DEFENSE COMMUNICATIONS SYSTEM (DCS)
ECM (Electronic Counter Measure) signal discrimination and identification techniques
[AD-A133427] N84-15372
DEFLAGRATION
Vapor cloud explosion experiments N84-15444
Analytical solutions for the flow field induced by a spherical flame expanding at constant velocity N84-15445
DEFORMATION
Crazing and fatigue behaviour of one and two phase polymers N84-15282
Welding deformations and residual stresses due to circumferential welding of cylindrical shells and hemispherical end plates
[BLL-DRIC-T-6968-(3623.66)] N84-15549
DEGREES OF FREEDOM
Digital multishaker modal testing
[NASA-CR-170951] N84-15522
DEHYDRATION
The effects of dehydration on peripheral cooling
[AD-A130838] N84-15767

DELAMINATING
Analysis of local delaminations and their influence on composite laminate behavior
[NASA-TM-85728] N84-15199
DELAY CIRCUITS
Time delay estimation using the adaptive delay element
[DE84-002042] N84-15403
DELIVERY
High-speed, low-altitude payload delivery using a single large ribbon parachute
[DE84-002731] N84-15128
DELTA MODULATION
Low rate transmission of video signals using adaptive delta modulation
[AD-A133145] N84-15363
DENSITY
The long term upper ocean study (LOTUS). Cruise summary and hydrographic data report, ENDEAVOR 97, April 1983
[AD-A134005] N84-15745
DENSITY DISTRIBUTION
Statistical modeling of Space Shuttle environmental data
[NASA-CR-170940] N84-15178
Application of the density matrix multipole expansion to stark quantum beats from beam-foil-excited hydrogen atoms
[AD-A133603] N84-15193
DEOXYRIBONUCLEIC ACID
Lethal, potentially lethal lesion model
[DE84-001325] N84-15762
DEPLOYMENT
Finite element analysis of a deployable space structure N84-16056
DEPOSITION
Ion plating in corrosion protection
[DE84-001162] N84-15256
DEPTH
Quantitative sputter profiling at surfaces and interfaces N84-15314
Depth resolution due to instrumental factors in sputter-assisted depth profiling N84-15315
Dip-moveout by Fourier transform N84-15699
DESCALING
The descaling of 3Cr12 steel N84-15322
DESIGN
Cascade Joule-Thomson refrigerators N84-15354
Flywheel energy-management systems for improving fuel economy of motor vehicles
[DE84-002340] N84-15688
DESIGN ANALYSIS
Tactical requirements impact on avionics/weapon system design N84-15036
Operational readiness and its impact on fighter avionics system design N84-15037
A future system design technique based on functional decomposition, supported by quantifiable design aims, and guidelines for minimum maintenance costs N84-15039
A practical approach to the design of a new avionic system N84-15058
Design considerations for remotely piloted, high-altitude airplanes powered by microwave energy
[NASA-TM-85730] N84-15145
ACOSS Fourteen (Active Control of Space Structures)
[AD-A133411] N84-15181
Design and use of nonstandard tensile specimens for irradiated materials testing
[DE84-001466] N84-15254
New polymers for low-gravity purification of cells by phase partitioning
[NASA-CR-170957] N84-15267
A miniature tilting pad gas lubricated bearing N84-15340
Spread spectrum transmission. Part 1: General characteristics
[FUB-49-1982-PT-1] N84-15385
The use of microprocessors for the instrumentation of nondestructive tests
[CISE-2072] N84-15571
Material selection and structural design for safety and durability
[NLR-MP-82023-U] N84-15617
Line-focusing adjustable parabolic solar-concentrating collector
[DE84-001590] N84-15687
A note on the analysis of random balance designs
[AD-A133287] N84-15848
Cross section estimates for multi-TeV physics N84-15914
DETECTION
Split-Stirling, linear-resonant, cryogenic refrigerators for detector cooling N84-15342
Adaptive protection of detecion systems operating by spread spectrum N84-15652
DETECTORS
Flow improvements in the circuit of the Langley 4- by 7-meter tunnel
[NASA-TM-85662] N84-15117
DETONABLE GAS MIXTURES
Unconfined gas explosions — conferences
[VKI-LS-1983-02] N84-15438
DETONATION
Equation of state for the detonation products of several simple explosives
[DE83-017266] N84-15290
Unconfined vapor cloud explosions: A review of recent theories and experiments N84-15439
Vapor cloud explosion experiments N84-15444
The relation between power and energy in the shock initiation of detonations. 1: Basic theoretical considerations and the effects of geometry
[AD-A133468] N84-15505
Optical diagnostics for condensed-phase shock-compressed molecular systems
[DE84-001172] N84-15510
DEUTERIUM
Some issues related to evolution of planetary atmospheres N84-16103
DEXTRANS
Countercurrent distribution of biological cells
[NASA-CR-170958] N84-15755
DIAGNOSIS
A performance-based technique for assessing equipment maintainability
[AD-A133518] N84-15809
Techniques for sensor-based diagnosis
[AD-A133297] N84-15814
DIAMONDS
Advantages of using diamond tools brazed under high vacuum
[CSIR-TRANS-1709] N84-15293
Surface and near-surface analysis of diamond by RBS N84-15302
DIELECTRICS
Millimeter wave guiding structures and antennas
[AD-A133528] N84-15376
DIESEL ENGINES
1981 CRC (Coordinating Research Council) diesel fuel low-temperature operability field test
[AD-A133543] N84-15289
Numerical experiments with CONCHAS-SPRAY: Compression stroke of an external chamber diesel engine
[DE84-002321] N84-15561
DIESEL FUELS
Development of quantitative infrared analysis for monitoring water and emulsifying agents in fire-resistant microemulsion diesel fuels
[AD-A133242] N84-15286
1981 CRC (Coordinating Research Council) diesel fuel low-temperature operability field test
[AD-A133543] N84-15289
DIFFERENTIAL EQUATIONS
Introduction to dynamic bifurcation
[AD-A133252] N84-15846
Elements of functions of a complex variable N84-15881
Linear and nonlinear aspects of rotordynamics N84-16034
DIFFUSION
Surface segration and diffusion investigations by means of AES N84-15319
Microinstabilities in the high latitude F region: A brief review
[DE84-001709] N84-15719
Ion-beam analysis and ion implantation in the study of diffusion
[DE84-000354] N84-16008
DIFFUSION WELDING
Diffusion films produced by heat treatment of electroplated coatings
[BLL-OA-TRANS-3082-(6196.3)] N84-15237
DIGESTING
Biological chemistry N84-15190
DIGITAL FILTERS
Adaptive protection of detecion systems operating by spread spectrum N84-15652
Design and microprocessor-based implementation of digital frequency selective filters for application in terrain roughness identification
[AD-A133459] N84-15826
Maximum entropy linear prediction method
[FUB-48-1982] N84-15857
DIGITAL NAVIGATION
AFTI/F-16: An integrated system approach to combat automation N84-15063
DIGITAL RADAR SYSTEMS
The development of a digital processing system for accurate range determinations — for Teleoperator Maneuvering Systems N84-16046
DIGITAL SYSTEMS
DEF STAN 00-18: A family of compatible digital interface standards N84-15049
Validation of digital systems in avionics and flight control applications handbook, volume 1
[AD-A133222] N84-15150
A study of digitally controlled flight control actuation
[AD-A133274] N84-15160
DIGITAL TECHNIQUES
The impact of the F/A-18 aircraft digital flight control system and displays on flight testing and safety N84-15091
Digital communication in the presence of impulsive noise N84-15392
Input-output characterization of an ultrasonic testing system by digital signal analysis
[NASA-CR-3756] N84-15565
F-region variability and HF-propagation N84-15658
A digital ferrite phase-shifter for high power S-band operation N84-15886
Reflectance measurements, part 2 N84-16028
Low-ionization emission regions in the nuclei of spiral galaxies N84-16100
DIMENSIONAL MEASUREMENT
Elastomeric impression materials and cleaning systems for residue removal
[RFP-3442] N84-15296
DIODES
Diode laser spectrophotometry for monitoring acetylene on-line in a liquefaction plant
[DE84-002117] N84-15548
DIRAC EQUATION
Future search for grand unified theory magnetic monopoles
[DE83-009451] N84-16015
DIRECTION FINDING
Confidence region for the evaluation of HF DF single site location systems
[AD-A133208] N84-15140
DIRECTIONAL CONTROL
Flying qualities experiments of rate command/attitude hold systems in the HFB 320 in-flight simulator
[DFVLR-FB-83-25] N84-15163
Orbital maneuvering vehicle simulation system on-board processing logic N84-16052
DIRECTIVITY
State-of-the-Art for assessing earthquake hazards in the United States. Report 20: The contribution of directivity focusing to earthquake intensities
[AD-A132893] N84-15716
DISASTERS
Appraisal of scientific resources for emergency management
[AD-A133285] N84-16062
DISCHARGE
Discharge cell for optogalvanic spectroscopy having orthogonal relationship between the probe laser and discharge axis
[NASA-CASE-NPO-16271-1] N84-15537
DISCRIMINANT ANALYSIS (STATISTICS)
Assessment of Fisher and logistic linear quadratic discrimation models
[ORNL/CSD-TM-200] N84-15865
DISCRIMINATION
Surface wave path corrections, deterministic discrimination and body wave attenuation
[AD-A133574] N84-15714
DISKS (SHAPES)
NASTRAN documentation for flutter analysis of advanced turbopropellers
[NASA-CR-167927] N84-15153
DISPLACEMENT
Nonlinear analysis of thin shells by the hybrid mixed finite-element method N84-15578
Finite element and boundary element analysis of large strain large displacement problems in elastoplasticity N84-15580
Theoretical and software considerations for nonlinear dynamic analysis
[NASA-CR-174504] N84-15589
DISPLAY DEVICES
Combined visualization N84-15043
The lock-on-before-launch weapon delivery and display/control consideration N84-15056
Color display technology in advanced fighter cockpits N84-15061
Flight Mechanics and System Design Lessons From Operational Experience
[AGARD-CP-347] N84-15076
The impact of the F/A-18 aircraft digital flight control system and displays on flight testing and safety N84-15091
The man-machine interface in new generation commercial aircraft N84-15096
Modern flight instrument displays as a major military aviation flight safety weakness N84-15098

Spatiotemporal characteristics of visual localization [AD-A133952] N84-15770
A study on airborne integrated display system and human information processing [NASA-TM-77338] N84-15789
Displaying colors of specified chrominance on a color graphics display [AD-A133591] N84-15817

DISRUPTING
Dissipation of magnetic energy during disruptive current termination --- disruptions in tokamak reactors [IPPJ-644] N84-15973

DISTRIBUTED PARAMETER SYSTEMS
Computer science and technology: Future information processing technology, 1983 [PB83-257618] N84-15820

DISTRIBUTION FUNCTIONS
On the fitting of Pearson curves to sums of independent random variables [AD-A133153] N84-15844
A note on the analysis of random balance designs [AD-A133287] N84-15848
Optical and X-ray selected samples of quasars: Evolution of the luminosity distributions N84-16090

DIURNAL VARIATIONS
Thermal tides in the atmosphere of Venus N84-15702

DOPED CRYSTALS
An In0 2Ga0 8As/GaAs, modulation-doped, strained-layer superlattice field-effect transistor [DE84-000136] N84-16006

DOPPLER EFFECT
Ionospheric factors affecting the performance of HF sky-wave sea-state radars N84-15656

DOPPLER RADAR
Relationships between thunderstorm mesoscale circulation and tornadogenesis N84-15727

DOSAGE
Status of research in progress at the Inhalation Toxicology Research Institute [DE83-012610] N84-15694
Acute intramuscular toxicity (LD50) of 1,1'-trimethylenebis (4-(Hydroxyiminomethyl) pyridinium bromide) monohydrate, (TMB-4) in male mice [AD-A133148] N84-15758

DOSIMETERS
Dose conversion factors for inhaled radionuclides [FOA-C-40184-A3] N84-15786

DRAFTING MACHINES
Off-line graphics processing: A case study [DE84-002420] N84-15832

DRAG
The effect of flow oscillations on cavity drag, and a technique for their control N84-15109

DRAG REDUCTION
Propulsion apparatus and method using boil-off gas from a cryogenic liquid --- controlling spacecraft attitude and drag [NASA-CASE-MFS-25946-1] N84-15183

DRAINAGE PATTERNS
Spatial reasoning to determine stream network from LANDSAT imagery [E84-10063] N84-15632

DRIFT RATE
Drift waves in rotating plasmas [DE84-000391] N84-15988

DROP TESTS
Investigations on the reproducibility of the results of drop weight tests by the method of W. S. Pellini [BLL-DRIC-T-6970-(3623.66)] N84-15517

DRYING
Temperature distributions, boiling and dry-out behind local blockages --- liquid metal fast breeder reactors (LMFBR) N84-15495

DUCTILITY
Use of the disk bend test to assess irradiation performance of structural alloys [DE84-001484] N84-15255
Effects of hydrogen on strength and ductility of tantalum N84-15260
Site-dependent inelastic response spectra N84-15620

DUCTS
Spinning mode acoustic radiation from the flight inlet [NASA-CR-172273] N84-15896

DUST
Infrared measurements of AFGL (Air Force Geophysics Laboratory) sources [AD-A133553] N84-16098

DYES
Rapid identification of micro-organisms [AD-A132831] N84-15759

DYNAMIC MODELS
Crew station evaluation in a dynamic flight simulation facility N84-15069
Improved dynamic models for air combat analysis [TAE-483] N84-15876

DYNAMIC PROGRAMMING
Theoretical and software considerations for nonlinear dynamic analysis [NASA-CR-174504] N84-15589
Application of the Gibbs distribution to image segmentation [AD-A133406] N84-15850

DYNAMIC RESPONSE
Electrofluidic angular rate sensor for ejection seat thrust vector control [AD-A133233] N84-15137
Multishaker modal testing [NASA-CR-170952] N84-15521
Eleventh NASTRAN User's Colloquium [NASA-CP-2284] N84-15590
An alternative method of analysis for base accelerated dynamic response in NASTRAN N84-15598
Finite element analysis of fluid-filled elastic piping systems N84-15600
Finite element analysis of a deployable space structure N84-16056

DYNAMIC STABILITY
Experimental determination of gap flow-conditioned forces at turbine stages and their effect on the running stability of simple rotors [NASA-TM-77293] N84-15553

DYNAMIC STRUCTURAL ANALYSIS
Wind tunnel tests on a model of a semisubmersible platform and comparison of the results with full-scale data [NLR-MP-82014-U] N84-15113
Study on damping representation related to spacecraft structural design [EMSB-18/83] N84-15182
Preflight transient dynamic analyses of B-52 aircraft carrying Space Shuttle solid rocket booster drop-test vehicle [NASA-TM-84925] N84-15588
Stiffness properties for dynamic modeling of composite graphite-epoxy cylindrical orthotropic shells N84-16054
Finite element analysis of a deployable space structure N84-16056

DYNAMIC TESTS
A dynamic approach to military avionics systems testing N84-15075

DYNAMOMETERS
NAHBE (Naval Academy Heat Balanced Engine) m151 retrofit evaluation [AD-A133475] N84-15559

E

EARLY STARS
Line profile variability in winds of OB stars N84-16085

EARTH (PLANET)
Constraints on the Earth's anelastic and aspherical structure from antipodal surface waves N84-15700
On the relationship between collisionless shock structure and energetic particle acceleration [NASA-CR-175328] N84-15909
Some issues related to evolution of planetary atmospheres N84-16103
Transport processes in planetary atmospheres N84-16104

EARTH CORE
Magnetic anomalies in east Pacific using MAGSAT data [E84-10060] N84-15630

EARTH CRUST
Investigation of antarctic crust and upper mantle using MAGSAT and other geophysical data [E84-10055] N84-15627
Magnetic anomalies in east Pacific using MAGSAT data [E84-10060] N84-15630
Synthesis of regional crust and upper-mantle structure from seismic and gravity data [E84-10061] N84-15631

EARTH MANTLE
Investigation of antarctic crust and upper mantle using MAGSAT and other geophysical data [E84-10055] N84-15627
Synthesis of regional crust and upper-mantle structure from seismic and gravity data [E84-10061] N84-15631
Lateral heterogeneity and azimuthal anistropy of the upper mantle: Love and Rayleigh waves 100-250 sec [NASA-CR-174619] N84-15710
The Norwegian Seismic Array (NORSAR). Phase 3 [AD-A134038] N84-15713

EARTH MOVEMENTS
State-of-the-Art for assessing earthquake hazards in the United States. Report 20: The contribution of directivity focusing to earthquake intensities [AD-A132893] N84-15716

EARTH ORBITS
A feasibility study of electromagnetic DE-spin system for Earth orbiting satellites N84-16040
Studies of neutron and proton nuclear activation in low-Earth orbit 2 N84-16041

EARTH RADIATION BUDGET EXPERIMENT
FGGE/ERBM tape specification and shipping letter description [NASA-CR-170547] N84-16072
FGGE/ERBZ tape specification and shipping letter description [NASA-CR-170548] N84-16073

EARTH ROTATION
Nonuniformity of the Earth's rotation and the motion of the poles [NASA-TM-77337] N84-15709

EARTHQUAKES
Site-dependent inelastic response spectra N84-15620
Interpretation of near-source ground motion and implications N84-15697
Constraints on the Earth's anelastic and aspherical structure from antipodal surface waves N84-15700
Effective use of earthquake data [AD-A134077] N84-15712
State-of-the-Art for assessing earthquake hazards in the United States. Report 20: The contribution of directivity focusing to earthquake intensities [AD-A132893] N84-15716

ECOLOGY
Methodology for the objective validation of model performance, with an application to atmospheric transport models [DE83-015693] N84-15693
Climate-chemistry connection [DE84-001950] N84-15739
A preliminary survey of plankton and periphyton in the Turn Barge Canal and basin area of Kennedy Space Center, Florida N84-16027

ECONOMIC ANALYSIS
Establishment and discontinuance criteria for airport traffic control towers [AD-A133461] N84-15141
Production networks: A dynamic model of production [AD-A133571] N84-16065

EDDY CURRENTS
Computation of the temperature distribution due to eddy-currents in the wall of a power transformer [PB83-217273] N84-15410
A feasibility study of electromagnetic DE-spin system for Earth orbiting satellites N84-16040

EDDY VISCOSITY
Introduction to turbulent shear flows N84-15449

EDGES
Acoustic diffraction by an impedance-covered edge [AD-A133266] N84-15904
Edge- and contour detection for correction of low-pass filtered images [PB83-217489] N84-15969

EDUCATION
Evaluation results for the interactive video competency recognition system [AD-A133052] N84-15796
`Classifying bugs is a tricky business [AD-A133264] N84-15813
A guideline for the planning and system requirement determination of a computer based educational system [AD-A133529] N84-15829
Artificial intelligence: An analysis of potential applications to training, performance measurement, and job performance aiding [AD-A133592] N84-15839
European Scientific Notes. Volume 37, number 9 [AD-A133558] N84-16079

EFFECTIVENESS
Evaluation results for the interactive video competency recognition system [AD-A133052] N84-15796
Performance appraisal revisited [AD-A132841] N84-16059

EFFICIENCY
Determination of freeze protection heat loss from a parabolic trough solar system [DE84-000005] N84-15689
Novette pulse-power-system description [DE83-018185] N84-15968

EFFLUENTS
Increased confidence in spectrum matching by use of a retention time library --- compound identification in industrial effluents [PB83-232090] N84-15229

Summary of annual environmental reports for CY 1981: Department of Energy nuclear sites
[DOE/EP-0038/1] N84-15692

EIGENVALUES
A NASTRAN DMAP procedure for calculation of base excitation modal participation factors N84-15599

EIGENVECTORS
A NASTRAN DMAP procedure for calculation of base excitation modal participation factors N84-15599
Possible tidal modulation of the Indian monsoon onset N84-15721

EJECTION SEATS
Electrofluidic angular rate sensor for ejection seat thrust vector control
[AD-A133233] N84-15137
Vernier Rocket Motor Mk 84 Mod 0 quality evaluation
[AD-A133301] N84-15185

ELASTIC BARS
Bending elasticity of circularly notched bars as monolithic flexure hinges in precision mechanisms
[DE84-002199] N84-15612

ELASTIC BENDING
Bending elasticity of circularly notched bars as monolithic flexure hinges in precision mechanisms
[DE84-002199] N84-15612

ELASTIC BODIES
Finite element analysis of fluid-filled elastic piping systems N84-15600

ELASTIC BUCKLING
Unified operator description, nonlinear buckling and post-buckling analysis of thin elastic shells
[RUB-IFM-MITT-34] N84-15582

ELASTIC DEFORMATION
We need simplicity and speed. Some examples of simple and fast methods for the measurement of deformations of structures
[NLR-MP-82021-U] N84-15616

ELASTIC PROPERTIES
Solution of elastic and elasto-plastic problems by the method of lines N84-15573
Unified operator description, nonlinear buckling and post-buckling analysis of thin elastic shells
[RUB-IFM-MITT-34] N84-15582

ELASTIC SCATTERING
Differences between positrons and electrons in elastic and inelastic processes at surfaces
[DE84-001208] N84-15953

ELASTIC SHELLS
Unified operator description, nonlinear buckling and post-buckling analysis of thin elastic shells
[RUB-IFM-MITT-34] N84-15582

ELASTIC WAVES
Characterization of the pressure wave originating in the explosion of a gas cloud N84-15446
Propagating plane harmonic waves through finite length plates of variable thickness using finite element techniques N84-15601

ELASTOMERS
Elastomeric impression materials and cleaning systems for residue removal
[RFP-3442] N84-15296

ELASTOPLASTICITY
Implementation of elastic-plastic structural analysis into NASTRAN N84-15606
Elastic-plastic analysis of annular plate problems using NASTRAN N84-15607

ELASTOSTATICS
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics
[AD-A133142] N84-15843

ELECTRIC BATTERIES
Calcium-thionyl chloride battery technology
[AD-A133570] N84-15401

ELECTRIC CONDUCTORS
Computation of the temperature distribution due to eddy-currents in the wall of a power transformer
[PB83-217273] N84-15410

ELECTRIC CONNECTORS
A modular twin bus microprocessor system for laboratory automation
[AD-A133372] N84-15815

ELECTRIC CURRENT
Beam processing for high-efficiency Si solar cells
[DE84-002059] N84-15690

ELECTRIC DISCHARGES
Evaluation of type 2 fast packs for electrostatic discharge properties
[AD-A133158] N84-15557

ELECTRIC ENERGY STORAGE
USAF advanced terrestrial energy study. Volume 3: Parameter survey
[AD-A133501] N84-15685

ELECTRIC FILTERS
Second-order adaptive infinite impulse response filter
[DE84-001768] N84-15406

ELECTRIC GENERATORS
Utilization of low temperatures in electrical machines
[AD-A133325] N84-15399
Recent advances in variable speed electrical generator systems for large wind turbines
[DE84-001833] N84-15404
Thermohydraulic applications of liquid metals in the non-nuclear field N84-15501

ELECTRIC POTENTIAL
Compact Claude cycle refrigerator for laboratory use N84-15338
Evaluation of type 2 fast packs for electrostatic discharge properties
[AD-A133158] N84-15557
Beam processing for high-efficiency Si solar cells
[DE84-002059] N84-15690
Current collection from the space plasma through defects in high voltage solar array insulation N84-15970

ELECTRIC POWER PLANTS
The design of modern Low Pressure (LP) steam turbines N84-15473

ELECTRIC POWER SUPPLIES
Advanced high-power generator for airborne applications
[AD-A133290] N84-15398

ELECTRICAL MEASUREMENT
The effects of space charge on ionic mobility measurements in cylindrical geometries N84-15993

ELECTRICAL PROPERTIES
The unique surface properties of gold N84-15310
Fabrication and properties of multilayer structures
[NASA-CR-174506] N84-15997

ELECTRICAL RESISTIVITY
Electrical conductivities of polycrystalline and single-crystal Er2O3-stabilized hafnia
[DE83-017681] N84-15279
Aspects of damping of sonic vibrations due to impact loading in plate steels
[BLL-M-35295-(5828.4)] N84-15895

ELECTRO-OPTICS
Testing and characterizations of infrared sensor over the temperature range of 2 Kelvin to 300 Kelvin N84-15347
Suitability of commercially available laboratory cryogenic refrigerators to support shipboard electro-optical systems in the 10 - 77 Kelvin region N84-15355

ELECTROACOUSTIC TRANSDUCERS
Results from wind tunnel and artificial rainfall tests of the modified scan sensor
[AD-A133236] N84-15162

ELECTROCHEMICAL CORROSION
Calcium-thionyl chloride battery technology
[AD-A133570] N84-15401

ELECTROCHEMISTRY
Electrically controlled coloration of materials
[AD-A133420] N84-15223
Luminescence probe studies of nafion polyelectrolytes
[AD-A133519] N84-15224
New polyconjugated oxidation-reduction polymers, as well as a method and apparatus for electrochemical regeneration
[DE84-002813] N84-15276
Electrochemical studies of redox systems for energy storage
[NASA-CR-174503] N84-15681

ELECTRODEPOSITION
New profilable bond system for diamond and CBN grinding wheels
[CSIR-TRANS-1707] N84-15294

ELECTRODES
Polymer coated electrodes in ambient temperature molten salts
[AD-A133202] N84-15220
Performance of computer-designed small-size multistage depressed collectors for a high-perveance traveling wave tube
[NASA-TP-2248] N84-15394

ELECTRODYNAMICS
Theory of pulse propagation and coherence in free electron
[AD-A133334] N84-15544

ELECTROHYDRODYNAMICS
Polymer characterization by electrohydrodynamic ionization mass spectrometry: Probing composition and chemistry of mixtures in solution N84-15264

ELECTROLYTES
Luminescence probe studies of nafion polyelectrolytes
[AD-A133519] N84-15224

ELECTROLYTIC CELLS
Discharge cell for optogalvanic spectroscopy having orthogonal relationship between the probe laser and discharge axis
[NASA-CASE-NPO-16271-1] N84-15537

ELECTROMAGNETIC COMPATIBILITY
Advanced Concepts for Avionics/Weapon System Design, Development and Integration
[AGARD-CP-343] N84-15034
Increasing significance of electromagnetic effects in modern aircraft development N84-15041
Computer graphics techniques for aircraft EMC analysis and design N84-15055
Design and verification of electromagnetic compatibility in airborne weapons systems N84-15066

ELECTROMAGNETIC FIELDS
Fourier optics for the Maxwell field: Formalism and applications
[DE84-002845] N84-15383

ELECTROMAGNETIC INTERACTIONS
Experience of the axial field spectrometer at the CERN ISR N84-15912

ELECTROMAGNETIC NOISE
Extraterrestrial radio noise and its effect on radar performance N84-15662

ELECTROMAGNETIC RADIATION
Reflection and transmission of electromagnetic waves at a rough interface between two different media
[PB83-217588] N84-15389
Diffraction of a plane electromagnetic wave by an elliptic cylinder: The multi-origin technique
[PB83-166769] N84-15390
High energy electromagnetic shower position measurement by a fine grained scintillation hodoscope N84-15928
A measurement of the response of an SCG1-C scintillation glass shower detector to 2-17.5 GeV positrons N84-15930
Electromagnetic, gravitational, and neutrino waves in flat and curved spacetime N84-16111

ELECTROMAGNETIC SCATTERING
Coherent electromagnetic wave propagation and scattering in random media
[AD-A133601] N84-15381
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
Multiple paths on the ocean surface N84-15666

ELECTROMAGNETIC SHIELDING
A systematic characterization of the effects of atmospheric electricity on the operational conditions of aircraft N84-15086

ELECTROMAGNETIC WAVE TRANSMISSION
Coherent electromagnetic wave propagation and scattering in random media
[AD-A133601] N84-15381
Reflection and transmission of electromagnetic waves at a rough interface between two different media
[PB83-217588] N84-15389

ELECTROMAGNETISM
Numerical electromagnetics code. Method of moments. User's guide supplement for NEC-3 for modeling buried wires
[DE84-002195] N84-15382
Airborne lightning characterization
[AD-A130627] N84-15733
A feasibility study of electromagnetic DE-spin system for Earth orbiting satellites N84-16040

ELECTROMECHANICAL DEVICES
Design and verification of electromagnetic compatibility in airborne weapons systems N84-15066

ELECTRON BEAMS
Duration of memory loss due to electron beam exposure
[AD-A132941] N84-15760
A 650 mm long liquid hydrogen target for use in a high intensity electron beam
[DE84-002552] N84-15955
An investigation of accelerating mechanisms in a plasma focus relevant to interrupting switches
[AD-A133462] N84-15983

ELECTRON BUNCHING
Fast asynchronous level 1 pre-trigger for electrons at L = 10/sup 33 cm-2 sec-1 N84-15933

ELECTRON CAPTURE
Simultaneous electron capture and excitation in ion-atom collisions
[DE83-005799] N84-15907

ELECTRON CYCLOTRON HEATING
Preionization and start-up in the ISX-B Tokamak using electron cyclotron heating at 28 GHz
[DE84-002261] N84-15984

ELECTRON DENSITY (CONCENTRATION)
Preionization and start-up in the ISX-B Tokamak using electron cyclotron heating at 28 GHz
[DE84-002261] N84-15984
The interstellar medium along the line of sight toward X Per N84-16101

ELECTRON DIFFRACTION
Diffraction techniques
[AD-A133254] N84-15944

Differences between positrons and electrons in elastic and inelastic processes at surfaces
[DE84-001208] N84-15953

ELECTRON ENERGY
Limiting energy spread at high laser intensities using phase space displacement
[AD-A133322] N84-15542
Thermal electron heating rate: A derivation
[NASA-TM-85124] N84-15941
Extraction of volume produced H(-) or D(-) ions from a sheet plasma I
[IPPJ-645] N84-15974

ELECTRON MICROSCOPY
Use of scanning electron microscopy in studying surface reactions of metals with hydrogen N84-15318

ELECTRON PLASMA
Radial structure of curvature-driven instabilities in hot-electron plasma
[DE84-002256] N84-15986

ELECTRON SPECTROSCOPY
Proceedings of Symposium on Surface Science and its Industrial Implications
[ISBN-0-7988-2417-4] N84-15298
The use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition N84-15307

ELECTRON TRAJECTORIES
Use of synchrotron radiation for electron identification at high luminosity N84-15935

ELECTRONIC AIRCRAFT
A study on airborne integrated display system and human information processing
[NASA-TM-77338] N84-15789

ELECTRONIC COUNTERMEASURES
ECM (Electronic Counter Measure) signal discrimination and identification techniques
[AD-A133427] N84-15372
Contending with jamming in decametric waves in an adaptive system of all-directional antennas N84-15653

ELECTRONIC EQUIPMENT TESTS
Avionics fault tree analyzer N84-15053

ELECTRONIC PACKAGING
Evaluation of type 2 fast packs for electrostatic discharge properties
[AD-A133158] N84-15557

ELECTRONICS
Analog fault diagnosis of large-scale electronic circuits
[AD-A133491] N84-15400

ELECTRONS
Muons and electrons in general N84-15938
Energy distributions and yields of secondary ions and electrons emitted by GIOTTO during Halley encounter
[DE84-001661] N84-16105

ELECTROPHORESIS
Evaluation of the separability of monodisperse polystyrene latex microspheres in a continuous flow electrophoresis system N84-16057

ELECTROPHYSIOLOGY
Neuronal adaptive mechanisms underlying intelligent information processing
[AD-A133694] N84-15776

ELECTROPLATING
Methods in competition with electroplating
[BLL-OA-TRANS-3037-(6196.3)] N84-15213
Diffusion films produced by heat treatment of electroplated coatings
[BLL-OA-TRANS-3082-(6196.3)] N84-15237

ELECTROPOLISHING
Ion plating in corrosion protection
[DE84-001182] N84-15256

ELECTROSTATIC WAVES
Plasma wave experiment for the ISEE-3 mission
[NASA-CR-175132] N84-15972

ELECTROSTATICS
High resolution ultraviolet laser spectroscopy of mercury and helium N84-15214
Evaluation of type 2 fast packs for electrostatic discharge properties
[AD-A133158] N84-15557
Introduction to the FORTRAN 14 programs Duvorol and Contact for the solution of 3 D elastostatic half-space contact problems with and without friction
[PB83-147421] N84-15833

ELEMENTARY PARTICLES
Major detectors in elementary particle physics
[LBL-91] N84-15910
Experience of the axial field spectrometer at the CERN ISR N84-15912

ELEVATION
The future in terrain elevation data processing at the Defense Mapping Agency
[AD-A133483] N84-15641
Prototype tidal data analysis for Mississippi Sound and adjacent areas
[AD-A134071] N84-15744

ELEVATORS (CONTROL SURFACES)
Determination of elevator and rudder hinge forces on the Learjet model 55 aircraft N84-15604

ELLIPSOIDS
Radiation patterns of an antenna mounted on the mid-section of an ellipsoid
[AD-A133203] N84-15365

ELLIPSOMETERS
The use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition N84-15307

ELLIPTIC DIFFERENTIAL EQUATIONS
Iterative techniques for the solution of elliptic finite difference equations N84-15435

ELLIPTICAL CYLINDERS
Diffraction of a plane electromagnetic wave by an elliptic cylinder: The multi-origin technique
[PB83-166769] N84-15390

ELLIPTICITY
Brief note of the stress intensity factor of elliptical cracks
[PB83-216911] N84-15618

EMBRITTLEMENT
Embrittlement of steels due to galvanizing or coating with zinc paint: An investigation of embrittlement in welding or heating operations — liquid metal embrittlement
[AERE-TR-4774] N84-15244
Effects of hydrogen on strength and ductility of tantalum N84-15260
Grain boundary segregation and cavity formation in creep embrittled Cr-Mo steels N84-15320

EMERGENCIES
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
Rate of initial recovery and subsequent radar monitoring performance following a simulated emergency involving startle
[AD-A133602] N84-15795
Appraisal of scientific resources for emergency management
[AD-A133285] N84-16062

EMISSION
High energy electromagnetic shower position measurement by a fine grained scintillation hodoscope N84-15928
A measurement of the response of an SCG1-C scintillation glass shower detector to 2-17.5 GeV positrons N84-15930

EMISSION SPECTRA
Periodic spectral variation in Cygnus X-2 and Scorpius X-1 N84-16088
Observations of the unidentified 3.3 microns emission feature in compact HII regions N84-16089

EMISSIVITY
Snow thickness and brightness temperature on multi-year ice
[AD-A133940] N84-15747

EMPLOYEE RELATIONS
Incentives for controlling the performance of high technology and professional employees
[AD-A134074] N84-16061

EMULSIONS
Development of quantitative infrared analysis for monitoring water and emulsifying agents in fire-resistant microemulsion diesel fuels
[AD-A133242] N84-15286

END PLATES
Welding deformations and residual stresses due to circumferential welding of cylindrical shells and hemispherical end plates
[BLL-DRIC-T-6968-(3623.66)] N84-15549

ENERGETIC PARTICLES
Surface and near-surface analysis of diamond by RBS N84-15302
Non-stochastic acceleration of protons in the magnetic neutral sheet
[IPPJ-646] N84-15975

ENERGY BANDS
Limiting energy spread at high laser intensities using phase space displacement
[AD-A133322] N84-15542

ENERGY CONSERVATION
NAHBE (Naval Academy Heat Balanced Engine) m151 retrofit evaluation
[AD-A133475] N84-15559
USAF advanced terrestrial energy study. Volume 3: Parameter survey
[AD-A133501] N84-15685

ENERGY CONSUMPTION
Process for isotope separation
[DE84-001983] N84-15507

ENERGY CONVERSION
Recycling the kinetic energy of an automobile
[DE83-004201] N84-15551

ENERGY DISSIPATION
Searching for limitations in capability due to high average rates N84-15919
Dissipation of magnetic energy during disruptive current termination — disruptions in tokamak reactors
[IPPJ-644] N84-15973

ENERGY DISTRIBUTION
Energy distributions and yields of secondary ions and electrons emitted by GIOTTO during Halley encounter
[DE84-001661] N84-16105

ENERGY LEVELS
Average vibrational energy transfer during a single collision of excited molecules with heat bath molecules
[AD-A133391] N84-15949

ENERGY SOURCES
Status of research in progress at the Inhalation Toxicology Research Institute
[DE83-012610] N84-15694

ENERGY STORAGE
Recycling the kinetic energy of an automobile
[DE83-004201] N84-15551
A thermodynamically consistent constitutive model for inelastic flow of materials N84-15581
Electrochemical studies of redox systems for energy storage
[NASA-CR-174503] N84-15681
USAF advanced terrestrial energy study. Volume 2: Technology handbook
[AD-A133272] N84-15684
USAF advanced terrestrial energy study. Volume 4: Analysis, data, and bibliography
[AD-A133514] N84-15686
Flywheel energy-management systems for improving fuel economy of motor vehicles
[DE84-002340] N84-15688

ENERGY TRANSFER
Average vibrational energy transfer during a single collision of excited molecules with heat bath molecules
[AD-A133391] N84-15949

ENGINE NOISE
Experimental methods in compressor noise studies — jet engine tone noise N84-15028
Study of noise-certification standards for aircraft engines. Volume 1: Noise-control technology for turbofan engines
[AD-A133386] N84-15157

ENGINE TESTS
A miniature tilting pad gas lubricated bearing N84-15340
Linear and nonlinear aspects of rotordynamics N84-16034

ENGINEERING DRAWINGS
Line-focusing adjustable parabolic splar-concentrating collector
[DE84-001590] N84-15687
Computer-Aided Structural Engineering (CASE) project. Reference manual: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133493] N84-15828

ENTROPY
The theory of an active magnetic regenerative refrigerator N84-15351

ENVIRONMENT EFFECTS
Response to W. W. Kellogg carbon dioxide and climatic change: Implications for mankind's future
[DE84-002723] N84-15737

ENVIRONMENT SIMULATION
Results from wind tunnel and artificial rainfall tests of the modified scan sensor
[AD-A133238] N84-15162

ENVIRONMENTAL CHEMISTRY
Environmental behavior of Technetium-99
[DP-1644] N84-15245

ENVIRONMENTAL TESTS
The effect of environment on the mechanical behavior of AS/3501-6 graphite/epoxy material
[AD-A133331] N84-15205
The influence of the environment on the mechanical characteristics of composite materials: Design considerations — polymer matrix composites
[INTA-INFORME-I-1/221/720/83047] N84-15281

ENVIRONMENTS
Organizational-climate dimensions: A conceptual and judgmental analysis
[AD-A132898] N84-16068

EPITAXY
Structural properties of epitaxial single layer metals on (110) B.C.C. metal substrates N84-15326
Organometallic epitaxy for GaAs/AlGaAs microwave transistors and integrated circuits
[AD-A133569] N84-16001

EPOXY COMPOUNDS
Resin development in advanced composites
[FOA-C-20509-F9] N84-15208

EPOXY MATRIX COMPOSITES
Resin development in advanced composites
[FOA-C-20509-F9] N84-15208
EPOXY RESINS
Rubber-modified epoxy and glass laminates for application to naval ship structures
[AD-A132305] N84-15204
Resin development in advanced composites
[FOA-C-20509-F9] N84-15208
EQUATIONS OF MOTION
Nonlinear inverse perturbation method in dynamic redesign N84-15107
Middle latitude forcing of a model tropical atmosphere with horizontally nonuniform basic states N84-15724
EQUATIONS OF STATE
Equation of state for the detonation products of several simple explosives
[DE83-017266] N84-15290
LARC: Computer codes for Lagrangian analysis of stress-guage data to obtain decomposition rates through correlation to thermodynamic variables
[DE84-002404] N84-15292
EQUILIBRIUM EQUATIONS
A survey of solution techniques for nonlinear finite element equations
[NLR-MP-82027-U] N84-15861
Equilibrium studies for low-aspect-ratio torsatrons
[DE84-002264] N84-15979
EQUILIBRIUM METHODS
A survey of solution techniques for nonlinear finite element equations
[NLR-MP-82027-U] N84-15861
EQUIPMENT SPECIFICATIONS
The creation of the NLR benchmark package and the performance of two new CDC computers with it
[NLR-MP-82015-U] N84-15819
ERGOMETERS
Development and assessment of the Monark cycle ergometer for anaerobic muscular exercise
[AD-A133173] N84-15523
EROSION
Abrasion-erosion resistance of concrete made with two aggregates, Stonewall Jackson Dam, West Virginia
[AD-A133432] N84-15357
ERROR ANALYSIS
New flight deck design in the light of the operational capabilities N84-15097
Effects of wall interference on unsteady transonic flows N84-15105
Measures against errors in the building process
[NRC/CNR-TT-2067] N84-15295
Moment estimators of defect pattern frequencies, allowing for inspection error
[AD-A133487] N84-15568
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15661
ERROR SIGNALS
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371
ERRORS
Incident reporting: Its role in aviation safety and the acquisition of human error data N84-15081
All-fiber gyroscope with optical-Kerr-effect compensation N84-15518
On the maximum likelihood estimate for logistic errors-in-variables regression models
[AD-A133253] N84-15868
ERS-1 (ESA SATELLITE)
The European Space Agency's Earth observation satellite programmes N84-15647
ESTIMATES
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
A note on the analysis of random balance designs
[AD-A133287] N84-15848
An estimation problem relating to subset selection for normal populations
[AD-A133387] N84-15870
ESTIMATING
Time delay estimation using the adaptive delay element
[DE84-002042] N84-15403
A law of the iterated logarithm for non-parametric regression function estimators
[AD-A133260] N84-15847
Experimental designs for quantal response models
[AD-A133416] N84-15851
On jackknifing kernel regression function estimators
[AD-A133236] N84-15867
ETCHING
Etching of defects on crystal surfaces N84-15300
ETHANE
Procedure for producing higher hydrocarbons
[NRC/CNR-TT-2073] N84-15217
ETHYLENE COMPOUNDS
Secondary ion emission from adsorbate layers on polycrystalline Ni N84-15306
EULER EQUATIONS OF MOTION
A lower-upper factored implicit scheme for the numerical solution of the Euler equations applied to arbitrary cascades N84-15111
An introduction to numerical methods suitable for the Euler equations N84-15431
Characterization of the pressure wave originating in the explosion of a gas cloud N84-15446
Explicit multistage finite volume procedure to solve the Euler equations for transonic flow N84-15464
EULER-CAUCHY EQUATIONS
The generalized Euler-Mascheroni constants N84-16024
EULER-LAGRANGE EQUATION
LARC: Computer codes for Lagrangian analysis of stress-guage data to obtain decomposition rates through correlation to thermodynamic variables
[DE84-002404] N84-15292
EVAPORATION
Stirling engines with controlled evaporation of a two-phase two-component working fluid
[DE83-017284] N84-15560
EVOKED RESPONSE (PSYCHOPHYSIOLOGY)
Evaluation of factors producing visual evoked response variability
[AD-A133917] N84-15772
EXCITATION
Multishaker modal testing
[NASA-CR-170952] N84-15521
A NASTRAN DMAP procedure for calculation of base excitation modal participation factors N84-15599
Simultaneous electron capture and excitation in ion-atom collisions
[DE83-005799] N84-15907
Average vibrational energy transfer during a single collision of excited molecules with heat bath molecules
[AD-A133391] N84-15949
State-to-state unimolecular reaction dynamics
[DE84-003009] N84-15952
Giant dipole resonances built on excited states
[DE84-001549] N84-15954
EXERCISE PHYSIOLOGY
Development and assessment of the Monark cycle ergometer for anaerobic muscular exercise
[AD-A133173] N84-15523
Differentiated ratings of perceived exertion and selected physiological responses during prolonged upper and lower body exercise
[AD-A134086] N84-15769
Experiments on factors that influence muscular function in man
[AD-A133928] N84-15771
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
EXHAUST EMISSION
Clean catalytic combustor program
[NASA-CR-168323] N84-15151
EXHAUST NOZZLES
Fluid shielding of high-velocity jet noise
[NASA-TP-2259] N84-15894
EXOBIOLOGY
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 252)
[NASA/-SP-7011(252)] N84-15763
EXOTHERMIC REACTIONS
Low-cost single-crystal turbine blades, volume 1
[NASA-CR-168218] N84-15247
EXPANSION
A study of accretion in compact sources: Disk precession and jet helicity N84-16038
EXPLORER SATELLITES
Data analysis and theoretical studies for atmospheric Explorer C, D and E
[NASA-CR-175121] N84-15711
EXPOSURE
Neurobehavioral effects of carbon monoxide (CO) exposure in humans protocol 1
[AD-A133891] N84-15774
Exposure chamber for studies of pollutant gases and aerosols in human subjects: Design considerations
[DE84-001135] N84-15785
EXTERNAL STORE SEPARATION
Navy's advanced aircraft armament system program concept objectives N84-15045
EXTERNAL STORES
TAS: A Transonic Aircraft/Store flow field prediction code
[NASA-CR-3721] N84-15114
EXTINCTION
Comment on the extinct paradox
[NASA-TM-85113] N84-15958
Determination of particle-size distribution by measuring the transmission of an aerosol in sedimentation
[AD-A133288] N84-15962
EXTRATERRESTRIAL RADIATION
Extraterrestrial radio noise and its effect on radar performance N84-15662
EYE MOVEMENTS
Spatiotemporal characteristics of visual localization
[AD-A133952] N84-15770
Spatial localization in strabismic observers
[AD-A132748] N84-15784

F

F REGION
F-region variability and HF-propagation N84-15658
Microinstabilities in the high latitude F region: A brief review
[DE84-001709] N84-15719
F-16 AIRCRAFT
System architecture: Key to future avionics capabilities N84-15035
F-18 AIRCRAFT
Advanced F/A-18 avionics N84-15049
FABRICATION
Arc spray fabrication of metal matrix composite monotape --- high temperature fiber-reinforced superalloy composites
[NASA-CASE-LEW-13828-1] N84-15203
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
Fabrication and properties of multilayer structures
[NASA-CR-174506] N84-15997
FACTOR ANALYSIS
A lower-upper factored implicit scheme for the numerical solution of the Euler equations applied to arbitrary cascades N84-15111
FACTORIZATION
Problems at the interface between perturbative and nonperturbative quantum chromodynamics
[DE84-002375] N84-16018
FAILURE
Breakdown processes in wire chambers, prevention and rate capability N84-15923
FAILURE ANALYSIS
Tornado autopilot measures to ensure survivability after failures N84-15094
Analysis of interlaminar stresses in thick composite laminates with and without edge delamination
[NASA-TM-85738] N84-15201
Status of fiber reinforced materials N84-15209
Measures against errors in the building process
[NRC/CNR-TT-2067] N84-15295
Integrated circuit failure mechanism detected by IMMA N84-15305
An evaluation of Techroll seal flexible joint material N84-16037
FAILURE MODES
An evaluation of Techroll seal flexible joint material N84-16037
FAR FIELDS
A review of source location/assessment techniques --- aeroacoustics N84-15029
FAR INFRARED RADIATION
Far Infrared Radiometric Spectrometer (FIRRS)
[AD-A133552] N84-15527
FAR ULTRAVIOLET RADIATION
Vacuum ultraviolet photofragmentation of H2O and NO2: Laboratory studies and atmospheric applications N84-15703
FARMLANDS
Analysis of data acquired by synthetic aperture radar over Dade County, Florida, and Acadia Parish, Louisiana
[E84-10067] N84-15636
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data
[E84-10068] N84-15637
FAST NEUTRONS
Bone blood flow measured by (41)Ar clearance formed by (44)Ca(n,(-)) (41)Ar
[DE83-017600] N84-15761
FASTENERS
Mechanical fastener
[NASA-CASE-LAR-12738-2] N84-15160
FATIGUE (MATERIALS)
Static and dynamic stiffness reduction of graphite/epoxy composite laminates under fatigue loading N84-15134
The effect of environment on the mechanical behavior of AS/3501-6 graphite/epoxy material
[AD-A133331] N84-15205
Fatigue damage-strength relationships in composite laminates. Volume 1
[AD-A133485] N84-15206

Biaxial fatigue of graphite/epoxy + or - 45 sub s tubes N84-15210
Investigation of fatigue crack-growth resistance of aluminum alloys under spectrum loading [AD-A133206] N84-15251
Theoretical and software considerations for nonlinear dynamic analysis [NASA-CR-174504] N84-15589
General method for fatigue analysis of vertical axis wind turbine blades [DE84-002654] N84-15613
Miniature center-cracked-tension specimen for fatigue crack growth testing [DE84-001470] N84-15615
Material selection and structural design for safety and durability [NLR-MP-82023-U] N84-15617

FATIQUE LIFE
Report on visit to the US and Europe in May 1983, covering the 1983 ICAF (International Committee on Aeronautical Fatigue) Meetings and related visits [AD-A133415] N84-15147
The effect of superposing ripple loading of maneuver load cycles [AD-A132653] N84-15148
Helix and Felix: Loading standards for use in the fatigue evaluation of helicopter rotor components [NLR-MP-82041-U] N84-15149
Elevated temperature low cycle fatigue of nickel base superalloys in the conventionally cast, directionally solidified and single crystal forms [AD-A133598] N84-15253

FATIQUE TESTS
Report on visit to the US and Europe in May 1983, covering the 1983 ICAF (International Committee on Aeronautical Fatigue) Meetings and related visits [AD-A133415] N84-15147

FAULT TOLERANCE
Towards the functional partitioning of highly integrated, fault tolerant avionics signal processors N84-15047
Simulation requirements to support the development of a fault tolerant avionic system N84-15072
Software testing of safety critical systems N84-15073

FAULT TREES
Avionics fault tree analyzer N84-15053

FEASIBILITY ANALYSIS
A feasibility study of electromagnetic DE-spin system for Earth orbiting satellites N84-16040

FEEDBACK CONTROL
Direct multivariable model reference adaptive control with applications to large structural systems N84-15840
Improved dynamic models for air combat analysis [TAE-483] N84-15876

FERRIMAGNETS
Magnetic-field considerations in superferric dipole [DE84-002573] N84-15892

FERRITES
A digital ferrite phase-shifter for high power S-band operation N84-15886

FERROMAGNETIC MATERIALS
Comparison of fracture-toughness measurements from ferritic-steel compact-tension and surface-flawed specimen [DE84-000895] N84-15240
The theory of an active magnetic regenerative refrigerator N84-15351

FIBER COMPOSITES
Strength theories of continuous and discontinuous fiber composites N84-15195

FIBER OPTICS
Bidirectional fiber optic cable adapter [AD-A133371] N84-15370
All-fiber gyroscope with optical-Kerr-effect compensation N84-15518
AlGaAsSb vapor phase epitaxy and laser program [AD-A133123] N84-15995

FIBER REINFORCED COMPOSITES
Stiffness changes in unidirectional composites caused by crack systems [CA-8311] N84-15198
Status of fiber reinforced materials N84-15209
Mechanical property characterization of F-100/934 graphite-epoxy composite material N84-16031

FIBER STRENGTH
Fracture behavior of unidirectional boron/aluminum composite laminates [NASA-CR-3753] N84-15196

FIBERS
Evaluation of type 2 fast packs for electrostatic discharge properties [AD-A133158] N84-15557
Synthesis of N-substituted silaneamines: Monomeric precursors of silicon carbide-nitride fibers N84-16033

FIELD EFFECT TRANSISTORS
Integrated circuit failure mechanism detected by IMMA N84-15305
An In0 2Ga0 8As/GaAs, modulation-doped, strained-layer superlattice field-effect transistor [DE84-000136] N84-16006

FIELD EMISSION
Field emission electric propulsion: Additional propellants: Further tests on indium and alloys [R684] N84-15186

FIELD THEORY (PHYSICS)
Lattice gauge theories [DE83-013114] N84-15906
Problems at the interface between perturbative and nonperturbative quantum chromodynamics [DE84-002375] N84-16018

FIGHTER AIRCRAFT
Operational readiness and its impact on fighter avionics system design N84-15037
Navy's advanced aircraft armament system program concept objectives N84-15045
Towards the functional partitioning of highly integrated, fault tolerant avionics signal processors N84-15047
Color display technology in advanced fighter cockpits N84-15061
Concept of a fighter aircraft weapon delivery system N84-15064
Concepts for avionic and weapon integration facilities N84-15070
Pilot human factors in stall/spin accidents of supersonic fighter aircraft N84-15102
Mach 0.6 to 3.0 flows over rectangular cavities [AD-A134579] N84-15121
Improved dynamic models for air combat analysis [TAE-483] N84-15876

FILAMENTS
Superconducting properties of Nb3Sn multifilamentary wires fabricated by internal tin process [DE83-018189] N84-16011

FILE MAINTENANCE (COMPUTERS)
BANDIT in NASTRAN N84-15591
FGGE/SMMR-30 tape specification and shipping letter description [NASA-CR-170550] N84-16074

FILM THICKNESS
A new non-destructive and standardless method for the thickness determination of thin films by XRF measurement N84-15308

FILTRATION
Screening and classification of ceramic powders [NASA-TM-77092] N84-15270

FINE STRUCTURE
EXAFS studies of the metallic glass La80Ga20 [DE84-002022] N84-15278

FINGERS
Appropriate lengths between phalanges of multijointed fingers for stable grasping [AD-A133448] N84-15806

FINITE DIFFERENCE THEORY
Aerothermal modeling. Executive summary [NASA-CR-168330] N84-15152
Asymptotic analysis of numerical wave propagation in finite difference equations [NASA-CR-175323] N84-15360
Comparison of steady state transitions in truncated spectral and finite difference models of two-dimensional shallow convection N84-15417
Introduction to computational fluid dynamics — conferences [VKI-LS-1983-01] N84-15429
Equations of fluid flow, finite difference approximations and basic mathematical properties of each N84-15430
Finite difference methods for convective-diffusive equations N84-15432
A finite difference technique for laminar and turbulent compressible boundary layers N84-15433
Finite-difference approximations of the Navier-Stokes equations for incompressible flows N84-15434
Iterative techniques for the solution of elliptic finite difference equations N84-15435
Iterative solution of the finite difference potential equations for subsonic and transonic flows N84-15436
Computational Fluid Dynamics, volume 1 — conferences [VKI-LS-1983-04-VOL-1] N84-15461
Practical three-dimensional mesh generation using transfinite interpolation N84-15463
The accuracy of the finite difference computations of recirculating free convective flows N84-15471
Fully coupled calculation of fluid flows with limited use of computer storage [DE84-002218] N84-15508
Solution of elastic and elasto-plastic problems by the method of lines N84-15573
Interpretation of near-source ground motion and implications N84-15697
Numerical modeling and fast-solver calculation of approximately normal shocks [NLR-MP-82026-U] N84-15856

FINITE ELEMENT METHOD
Nonlinear inverse perturbation method in dynamic redesign N84-15107
Bladed-shrouded-disc aeroelastic analyses: Computer program updates in NASTRAN level 17.7 [NASA-CR-165428] N84-15154
User's manual for GAMNAS: Geometric and Material Nonlinear Analysis of Structures [NASA-TM-85734] N84-15200
Finite element analysis of moisture and external loading effects in composites N84-15211
An assumed deviatoric stress-velocity-pressure mixed finite element method for unsteady convective, incompressible viscous flow N84-15420
Introduction to computational fluid dynamics — conferences [VKI-LS-1983-01] N84-15429
Equations of fluid flow, finite difference approximations and basic mathematical properties of each N84-15430
Finite element methods for potential flows N84-15437
Application of interactive computer graphics in finite element analysis N84-15575
An integrated system for shells with discontinuities: Geometric modelling and finite element analysis N84-15576
Nonlinear analysis of thin shells by the hybrid mixed finite-element method N84-15578
Finite element and boundary element analysis of large strain large displacement problems in elastoplasticity N84-15580
Theoretical and software considerations for nonlinear dynamic analysis [NASA-CR-174504] N84-15589
Eleventh NASTRAN User's Colloquium [NASA-CP-2284] N84-15590
BANDIT in NASTRAN N84-15591
Using PAFEC as a preprocessor for COSMIC/NASTRAN N84-15593
The GPRIME approach to finite element modeling N84-15594
Orthotropic hole element N84-15595
Generalizing the TRAPRG and TRAPAX finite elements N84-15596
Acoustical modes of arbitrary volumes using NASTRAN transient heat transfer RF9 N84-15597
Finite element analysis of fluid-filled elastic piping systems N84-15600
Propagating plane harmonic waves through finite length plates of variable thickness using finite element techniques N84-15601
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602
Dynamic certification of a thrust-measuring system for large solid rocket motors N84-15603
Implementation of elastic-plastic structural analysis into NASTRAN N84-15606
Efficient large-scale finite-element computations in a CRAY environment [DE83-014946] N84-15818
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics [AD-A133142] N84-15843
Explicit second order splitting schemes for solving hyperbolic nonlinear problems: Theory and application to transonic flow [ESA-TT-768] N84-15855
A survey of solution techniques for nonlinear finite element equations [NLR-MP-82027-U] N84-15861
Finite element analysis of a deployable space structure N84-16056

FINITE VOLUME METHOD
Calculation of transonic flow around two wing-fuselage combinations using a full potential equation method [FFA-137] N84-15132
Explicit multistage finite volume procedure to solve the Euler equations for transonic flow N84-15464
Vector coding the finite volume procedure for the CYBER 205 N84-15465
Some new developments in exact integral equation formulations for sub- or transonic potential flow [NLR-MP-82024-U] N84-15860

FINS
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies [AD-A133399] N84-15169
Determination of elevator and rudder hinge forces on the Learjet model 55 aircraft N84-15604
Tube vibration in industrial-size test heat exchanger (90 deg square layout) [DE83-011931] N84-15614

FIRE CONTROL
Connecting aircraft and external loads N84-15046
FLAME HOLDERS
A review of theories currently being used to model steady plane flames on flame-holders [CA-8316] N84-15218
Second order theory of unsteady burned-anchored flames with arbitrary Lewis number [CA-8313] N84-15219
FLAME PROPAGATION
Identification of problem areas — unconfined gas explosions N84-15440
Analytical solutions for the flow field induced by a spherical flame expanding at constant velocity N84-15445
FLAME RETARDANTS
Phosphorous-containing imide resins — flame resistant composite materials [NASA-CASE-ARC-11368-3] N84-15202
FLAME STABILITY
A review of theories currently being used to model steady plane flames on flame-holders [CA-8316] N84-15218
FLAME TEMPERATURE
Second order theory of unsteady burned-anchored flames with arbitrary Lewis number [CA-8313] N84-15219
FLIGHT CHARACTERISTICS
Flying qualities experiments of rate command/attitude hold systems in the HFB 320 in-flight simulator [DFVLR-FB-83-25] N84-15163
FLIGHT CONDITIONS
Flight Mechanics and System Design Lessons From Operational Experience [AGARD-CP-347] N84-15076
FLIGHT CONTROL
Advanced F/A-18 avionics N84-15048
The impact of the F/A-18 aircraft digital flight control system and displays on flight testing and safety N84-15091
Lessons learned in the development of the F-16 flight control system N84-15092
Validation of digital systems in avionics and flight control applications handbook, volume 1 [AD-A133222] N84-15150
AFTI/F-16 flight test results and lessons [NASA-TM-84920] N84-15159
A study of digitally controlled flight control actuation [AD-A133274] N84-15160
FLIGHT CREWS
Avionics/crew station integration N84-15042
Guidelines and criteria for the functional integration of avionic systems with crew members in command N84-15044
Certification experience with methods for minimum crew demonstration N84-15101
Medical aspects of survival: Training for aircrew [AGARD-AG-283(FR)] N84-15787
FLIGHT HAZARDS
Flight Mechanics and System Design Lessons From Operational Experience [AGARD-CP-347] N84-15076
Some comments on the hazards associated with manoeuvring flight in severe turbulence at high speed and low altitude N84-15089
FLIGHT INSTRUMENTS
Modern flight instrument displays as a major military aviation flight safety weakness N84-15098
FLIGHT RECORDERS
The use of flight recorders in the investigation of aircraft mishaps N84-15078
The Civil Aircraft Airworthiness Data Recording Programme N84-15079
Flight parameters recording for safety monitoring and investigations N84-15083
FLIGHT SAFETY
Flight Mechanics and System Design Lessons From Operational Experience [AGARD-CP-347] N84-15076
Incident reporting: Its role in aviation safety and the acquisition of human error data N84-15081
The analysis of records of parameters: An indispensable tool in oversight and in operations control N84-15082
Influence of windshear on flight safety N84-15088
The MIRAGE 2000: Fly by wire control and safety N84-15093
Modern flight instrument displays as a major military aviation flight safety weakness N84-15098
FLIGHT SIMULATION
Crew station evaluation in a dynamic flight simulation facility N84-15069
Flying qualities experiments of rate command/attitude hold systems in the HFB 320 in-flight simulator [DFVLR-FB-83-25] N84-15163
Optical flow and texture variables useful in simulating self motion (2) [AD-A133597] N84-15779
FLIGHT STRESS (BIOLOGY)
Sleep and wakefulness handbook for flight medical officers [AGARD-AG-270(FR)] N84-15788
FLIGHT TESTS
Rotorcraft icing technology: An update N84-15084
The impact of the F/A-18 aircraft digital flight control system and displays on flight testing and safety N84-15091
Calibration of air-data systems and flow direction sensors. AGARD Flight Test Techniques Series, volume 1 [AGARD-AG-300-VOL-1] N84-15530
A mercuric detector system for X-ray astronomy. 2. Results from flight tests of a balloon borne instrument [NASA-CR-175329] N84-16095
FLIR DETECTORS
Analysis of US Coast Guard HU-25A visual and radar detection performance [AD-A133380] N84-15138
Suitability of commercially available laboratory cryogenic refrigerators to support shipboard electro-optical systems in the 10 - 77 Kelvin region N84-15355
FLORIDA
Analysis of data acquired by synthetic aperture radar over Dade County, Florida, and Acadia Parish, Louisiana [E84-10067] N84-15636
FLOTATION
Surface chemistry in the flotation of minerals N84-15323
Spectroscopic studies on surface reactions between minerals and reagents in flotation systems N84-15324
FLOW CHARACTERISTICS
Flow mechanism and experimental investigation of a rotating stall in transonic compressors [NASA-TM-77373] N84-15122
An experimental investigation of the boundary layer structures in a partially-filled horizontal and rapidly-rotating cylinder N84-15414
FLOW DIRECTION INDICATORS
Calibration of air-data systems and flow direction sensors. AGARD Flight Test Techniques Series, volume 1 [AGARD-AG-300-VOL-1] N84-15530
FLOW DISTRIBUTION
TAS: A Transonic Aircraft/Store flow field prediction code [NASA-CR-3721] N84-15114
Three-dimensional effects on airfoils [NASA-TM-77025] N84-15118
Mach 0.6 to 3.0 flows over rectangular cavities [AD-A134579] N84-15121
Inlet flow field investigation. Part 1: Transonic flow field survey [NASA-CR-172239] N84-15123
An experimental study of airfoil-spoiler aerodynamics N84-15133
Eddy detection within turbulent shear flows N84-15453
Large scale motion in turbulent boundary layers N84-15455
Acoustic shocks in a variable area duct containing near sonic flows [NASA-CR-172274] N84-15897
FLOW EQUATIONS
Introduction to computational fluid dynamics — conferences [VKI-LS-1983-01] N84-15429
Equations of fluid flow, finite difference approximations and basic mathematical properties of each N84-15430
An introduction to numerical methods suitable for the Euler equations N84-15431
A finite difference technique for laminar and turbulent compressible boundary layers N84-15433
Iterative solution of the finite difference potential equations for subsonic and transonic flows N84-15436
Finite element methods for potential flows N84-15437
Analytical solutions for the flow field induced by a spherical flame expanding at constant velocity N84-15445
Introduction to turbulent shear flows N84-15449
Computational Fluid Dynamics, volume 1 — conferences [VKI-LS-1983-04-VOL-1] N84-15461
Computational Fluid Dynamics, volume 2 — conferences [VKI-LS-1983-04-VOL-2] N84-15467
Numerical computation of transonic flow governed by the full-potential equation N84-15469
Turbulence modeling in liquid metal free convection — in reactor cooling systems N84-15490
A thermodynamically consistent constitutive model for inelastic flow of materials N84-15581
A numerical investigation of the multiple vortex phenomenon: Vortex number and structure as a function of swirl ratio N84-16049
FLOW MEASUREMENT
Flow mechanism and experimental investigation of a rotating stall in transonic compressors [NASA-TM-77373] N84-15122
Experimental techniques for free edges of turbulent flows N84-15450
Measurements in steam turbines N84-15476
Calibration of air-data systems and flow direction sensors. AGARD Flight Test Techniques Series, volume 1 [AGARD-AG-300-VOL-1] N84-15530
FLOW STABILITY
Bifurcations in nonlinear problems of hydrodynamic instability of plane parallel shear flows N84-15411
FLOW THEORY
Flow mechanism and experimental investigation of a rotating stall in transonic compressors [NASA-TM-77373] N84-15122
Introduction to computational fluid dynamics — conferences [VKI-LS-1983-01] N84-15429
Equations of fluid flow, finite difference approximations and basic mathematical properties of each N84-15430
An introduction to numerical methods suitable for the Euler equations N84-15431
Introduction to turbulent shear flows N84-15449
Turbine aerodynamic design using through-flow theory. Meridional through-flow calculation N84-15474
Applications of through-flow theory — steam turbines N84-15477
A review of current research activity on the aerodynamics of axial flow turbines N84-15480
Vibration-induced flux variation in the space between two concentric tubes [BLL-CE-TRANS-7949-(9022.09)] N84-15583
FLOW VELOCITY
Second order theory of unsteady burned-anchored flames with arbitrary Lewis number [CA-8313] N84-15219
Tube vibration in industrial-size test heat exchanger (90 deg square layout) [DE83-011931] N84-15614
Development of a consensus standard for determining thermal performance of high-concentration-ratio solar collectors [DE83-005129] N84-15676
FLOW VISUALIZATION
A study of helicopter rotor aerodynamics in ground-effect at low speeds N84-15106
An experimental study of airfoil-spoiler aerodynamics N84-15133
An experimental investigation of the structure of a turbulent reattaching flow behind a backward-facing step N84-15415
Flow visualization and LDV measurement of turbulent mixing layers [REPT-606] N84-15424
Experimental techniques for free edges of turbulent flows N84-15450
FLUID DYNAMICS
Mach 0.6 to 3.0 flows over rectangular cavities [AD-A134579] N84-15121
Fluid thermodynamics [ESA-TT-778] N84-15512
FLUID FLOW
Fully coupled calculation of fluid flows with limited use of computer storage [DE84-002218] N84-15508
Fluid thermodynamics [ESA-TT-778] N84-15512
FLUID JETS
New investigation of short wings with lateral jets [NASA-TM-77347] N84-15124
FLUID MANAGEMENT
Liquid management in low gravity using baffled rotating containers [NASA-TP-2263] N84-15427
FLUID MECHANICS
Fluid thermodynamics [ESA-TT-778] N84-15512
FLUID-SOLID INTERACTIONS
Surface chemistry in the flotation of minerals N84-15323
FLUIDICS
Electrofluidic angular rate sensor for ejection seat thrust vector control [AD-A133233] N84-15137
FLUIDS
Direct steam generation in line-focus solar collectors [DE83-006030] N84-15678

FLUORESCENCE
High resolution ultraviolet laser spectroscopy of mercury and helium N84-15214
Vacuum ultraviolet photofragmentation of H2O and NO2: Laboratory studies and atmospheric applications N84-15703
Rapid identification of micro-organisms [AD-A132831] N84-15759
State-to-state unimolecular reaction dynamics [DE84-003009] N84-15952
FLUOROPOLYMERS
Luminescence probe studies of nafion polyelectrolytes [AD-A133519] N84-15224
FLUTTER
Aeroelastic analysis of a Darrieus type wind turbine blade with troposkien geometry N84-15623
FLUTTER ANALYSIS
NASTRAN documentation for flutter analysis of advanced turbopropellers [NASA-CR-167927] N84-15153
FLY BY WIRE CONTROL
The impact of the F/A-18 aircraft digital flight control system and displays on flight testing and safety N84-15091
Lessons learned in the development of the F-16 flight control system N84-15092
The MIRAGE 2000: Fly by wire control and safety N84-15093
Certification experience of the Jaguar fly-by-wire demonstrator aircraft integrated flight control system N84-15095
FLYWHEELS
Flywheel energy-management systems for improving fuel economy of motor vehicles [DE84-002340] N84-15688
FOAMS
Surface chemistry in the flotation of minerals N84-15323
Partial analysis of Insta-Foam N84-16030
FOCUSING
Implementation of automatic focusing algorithms for a computer vision system with camera control [AD-A133492] N84-15807
FOG
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1 [AD-A133587] N84-15380
FOILS (MATERIALS)
Application of the density matrix multipole expansion to stark quantum beats from beam-foil-excited hydrogen atoms [AD-A133603] N84-15193
FORCE DISTRIBUTION
Middle latitude forcing of a model tropical atmosphere with horizontally nonuniform basic states N84-15724
FORCED CONVECTION
Mixed convection and stratification phenomena in liquid metals N84-15488
Thermohydraulics in liquid metals N84-15491
Liquid metal experimental facilities --- fast breeder reactors N84-15492
FORECASTING
A comparison of NMC models (1977) on precipitation forecasts for east coast cyclogenesis N84-15720
FORESTS
A correlation analysis of percent canopy closure versus TMS spectral response for selected forest sites in the San Juan National Forest, Colorado [E84-10066] N84-15635
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data [E84-10068] N84-15637
FORMAT
Combined visualization N84-15043
A new method for generating and maintaining rigid formats in NASTRAN N84-15605
FORTRAN
Introduction to the FORTRAN 14 programs Duvorol and Contact for the solution of 3 D elastostatic half-space contact problems with and without friction [PB83-147421] N84-15833
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics [AD-A133142] N84-15843
Processing time using Datatrieve-11, clunks, and FORTRAN [DE84-001706] N84-16081
FOUNDRIES
Choice of a melting installation for aluminum alloy [BLL-OA-TRANS-3095-(6196.3)] N84-15239
FOURIER TRANSFORMATION
Fourier optics for the Maxwell field: Formalism and applications [DE84-002845] N84-15383
Dip-moveout by Fourier transform N84-15699
Stationary stochastic processes --- spectrum analysis [ESA-TT-812] N84-15875
FRACTURE MECHANICS
Status of fiber reinforced materials N84-15209
The nature of quasicleavage fracture in tempered 5.5 ni steel after hydrogen charging [AD-A133460] N84-15252
A thermodynamically consistent constitutive model for inelastic flow of materials N84-15581
Material selection and structural design for safety and durability [NLR-MP-82023-U] N84-15617
Microcrack damage model of brittle rock [DE84-002088] N84-15717
Introduction to the FORTRAN 14 programs Duvorol and Contact for the solution of 3 D elastostatic half-space contact problems with and without friction [PB83-147421] N84-15833
FRACTURE STRENGTH
Comparison of fracture-toughness measurements from ferritic-steel compact-tension and surface-flawed specimen [DE84-000895] N84-15240
Fracture resistance of hardened and tempered pipes of 16GFR steel [BLL-M-35268-(5828.4)] N84-15584
Plane strain fracture toughness of polyethylene pipe materials [MIT-RR-R2-2] N84-15586
Refined test methods in evaluating brittle material strengths [AD-A133596] N84-15610
FRACTURING
Investigation of static and dynamic fracture of orthotropic media by photomechanics N84-15625
FRANCE
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States [AD-A133150] N84-15777
FREE BOUNDARIES
Experimental techniques for free edges of turbulent flows N84-15450
FREE CONVECTION
Mixed convection and stratification phenomena in liquid metals N84-15488
Turbulence modeling in liquid metal free convection --- in reactor cooling systems N84-15490
FREE ELECTRON LASERS
A low loss quasioptical cavity for a two-stage Free Electron Laser (FEL) [AD-A133321] N84-15541
Limiting energy spread at high laser intensities using phase space displacement [AD-A133322] N84-15542
Theory of pulse propagation and coherence in free electron [AD-A133334] N84-15544
Two-stage FEL (Free Electron Laser) program [AD-A133508] N84-15546
FREE FLOW
Asymmetric turbulent flows N84-15451
The accuracy of the finite difference computations of recirculating free convective flows N84-15471
FREE VIBRATION
Aeroelastic analysis of a Darrieus type wind turbine blade with troposkien geometry N84-15623
FREEZING
Aerostat icing problems [AD-A133403] N84-15272
FREQUENCY DISTRIBUTION
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
FREQUENCY HOPPING
Spread spectrum transmission. Part 1: General characteristics [FUB-49-1982-PT-1] N84-15385
Broadband base isolated asymmetrically fed VHF antenna N84-15393
FREQUENCY MODULATION
A FMCW radar ranging device for the teleoperator maneuvering system N84-16045
FRICTION
Introduction to the FORTRAN 14 programs Duvorol and Contact for the solution of 3 D elastostatic half-space contact problems with and without friction [PB83-147421] N84-15833
FRONTS (METEOROLOGY)
Investigation of the arc cloud complex N84-16029
FUEL COMBUSTION
Broad specification fuels combustion technology program [NASA-CR-168179] N84-15283
Advanced Gas Turbine (AGT) technology development [NASA-CR-168235] N84-15554
FUEL CONSUMPTION
Fuel economy in aviation [NASA-SP-462] N84-15144
NAHBE (Naval Academy Heat Balanced Engine) m151 retrofit evaluation [AD-A133475] N84-15559
FUEL PRODUCTION
Procedure for producing higher hydrocarbons [NRC/CNR-TT-2073] N84-15217
FUEL TANKS
Permeability of flexible materials used in fuel storage tanks. Part 2: A method of measurement and preliminary results [AD-A133451] N84-15558
FUEL-AIR RATIO
Chemical kinetics modeling of engine knock: Preliminary results [DE84-001236] N84-15226
FUELS
Combustion at the interface of an oxidizer-fuel slab system N84-15215
FUNCTION SPACE
Optimal reconstructions and n-widths [AD-A133576] N84-15853
FUNCTIONAL DESIGN SPECIFICATIONS
Helix and Felix: Loading standards for use in the fatigue evaluation of helicopter rotor components [NLR-MP-82041-U] N84-15149
Radiation effects in the Joint European Torus Experiment: Guidelines for preliminary design [R857/2] N84-15971
FUNCTIONS (MATHEMATICS)
Constrained function minimization. Comparison of the augmented Lagrangian and sequentially increasing penalty method [PB83-217265] N84-15863
FURNACES
Choice of a melting installation for aluminum alloy [BLL-OA-TRANS-3095-(6196.3)] N84-15239
FUSELAGES
Wind tunnel investigations of glider fuselages with different waistings and wing arrangements N84-15116

G

GALACTIC RADIATION
Studies of highly variable galactic X-ray sources with HEAO-1 [NASA-CR-170941] N84-16112
GALACTIC STRUCTURE
Infrared measurements of AFGL (Air Force Geophysics Laboratory) sources [AD-A133553] N84-16098
GALILEO PROJECT
JPL closeup [NASA-CR-175324] N84-15168
GALLIUM ALLOYS
EXAFS studies of the metallic glass La80Ga20 [DE84-002022] N84-15278
GALLIUM ARSENIDES
Control of impurities in the epitaxial growth of high quality GaAs [AD-A133187] N84-15996
Organometallic epitaxy for GaAs/AlGaAs microwave transistors and integrated circuits [AD-A133569] N84-16001
An In0 2Ga0 8As/GaAs, modulation-doped, strained-layer superlattice field-effect transistor [DE84-000136] N84-16006
GAME THEORY
Improved dynamic models for air combat analysis [TAE-483] N84-15876
A minimax theorem for antijamming group codes [DFVLR-FB-83-30] N84-15879
GAMMA RAY ABSORPTIOMETRY
Statistical modeling of Space Shuttle environmental data [NASA-CR-170940] N84-15178
GAMMA RAY SPECTRA
Statistical modeling of Space Shuttle environmental data [NASA-CR-170940] N84-15178
Giant dipole resonances built on excited states [DE84-001549] N84-15954
GAMMA RAY SPECTROMETERS
Life test performance of a Philips rhombic-drive refrigerator with bellows seals N84-15341
GAS BEARINGS
A miniature tilting pad gas lubricated bearing N84-15340

GAS CHROMATOGRAPHY
Complete sample analysis by gas chromatography [BLL-T6213/BG/LRS/LRST671/83] N84-15212
Increased confidence in spectrum matching by use of a retention time library --- compound identification in industrial effluents [PB83-232090] N84-15229
A general computer model for predicting the performance of gas sorption refrigerators N84-15349

GAS COOLING
Optimal design of gas adsorption refrigerators for cryogenic cooling N84-15348

GAS DYNAMICS
An application of gap regenerator/expander precooled by two stage G-M refrigerator N84-15337
Unconfined gas explosions --- conferences [VKI-LS-1983-02] N84-15438
Unconfined vapor cloud explosions: A review of recent theories and experiments N84-15439
Identification of problem areas --- unconfined gas explosions N84-15440
Practical approaches in accident analysis --- unconfined gas explosions N84-15441
Flat cloud modeling --- unconfined gas explosions N84-15442
Wet steam flow in L. P. turbines --- low pressure (LP) N84-15483
A new numerical method for the transient gas-dyanmic code EVENT [LA-9594-MS] N84-15977

GAS EXCHANGE
Interaction of anti-G measures and chest wall mechanics in determining gas exchange [AD-A133740] N84-15775

GAS EXPLOSIONS
Unconfined gas explosions --- conferences [VKI-LS-1983-02] N84-15438
Unconfined vapor cloud explosions: A review of recent theories and experiments N84-15439
Identification of problem areas --- unconfined gas explosions N84-15440
Practical approaches in accident analysis --- unconfined gas explosions N84-15441
Flat cloud modeling --- unconfined gas explosions N84-15442
Estimate of blast wave properties --- unconfined vapor cloud explosions (UVCE) N84-15443
Vapor cloud explosion experiments N84-15444
Analytical solutions for the flow field induced by a spherical flame expending at constant velocity N84-15445
Characterization of the pressure wave originating in the explosion of a gas cloud N84-15446
Interaction of gas explosions with buildings N84-15447

GAS FLOW
Jet-impact nebulization for sample introduction in inductively coupled plasma spectrometry [AD-A133152] N84-15982

GAS MIXTURES
The relation between power and energy in the shock initiation of detonations. 1: Basic theoretical considerations and the effects of geometry [AD-A133468] N84-15505
Influence of Ar + CO2 shielding on the composition of a Cr-Mo-V weld [BLL-CE-TRANS-8000-(9022.09)] N84-15550

GAS TUNGSTEN ARC WELDING
Sensor control of robot arc welding N84-16047

GAS TURBINE ENGINES
Broad specification fuels combustion technology program [NASA-CR-168179] N84-15283

GAS TURBINES
Aerothermal modeling, phase 1. Volume 1: Model assessment [NASA-CR-168296-VOL-1] N84-15155
Advanced Gas Turbine (AGT) technology development [NASA-CR-168235] N84-15554

GAS-METAL INTERACTIONS
Oxygen adsorption and initial oxidation of single crystal first row transition metal and alloy surfaces N84-15316
Kinematics of the structure and morphology during surface reactions between transition metals and molecular hydrogen N84-15317

GAS-SOLID INTERACTIONS
Interaction of gas explosions with buildings N84-15447
Interactions of vibrationally excited molecules with solid surfaces [AD-A133449] N84-15950

GAS-SOLID INTERFACES
Computation of turbulent gas-particle suspension flows in channels N84-15470

GASES
Review of properties of various types of calorimeters: High luminosity and high energy N84-15917

GASIFICATION
Gasogen for automobile use [DE84-000712] N84-15291

GASOLINE
1981 CRC octane number requirement survey [AD-A133369] N84-15288

GATES (CIRCUITS)
Nanosecond image-shuttering studies at Los Alamos National Laboratory [DE84-001733] N84-15405

GEOCHEMISTRY
Uranium anomalies in Wyoming and parts of adjacent states. National Uranium Resource Evaluation [DE83-005353] N84-15638

GEODIMETERS
Advanced techniques of laser telemetry N84-15883

GEOIDS
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15661

GEOLOGICAL FAULTS
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields --- California and Pennsylvania [E84-10057] N84-15628

GEOLOGICAL SURVEYS
Uranium anomalies in Wyoming and parts of adjacent states. National Uranium Resource Evaluation [DE83-005353] N84-15638

GEOLOGY
Theoretical and empirical terrestrial heat flow studies N84-15696

GEOMAGNETISM
Investigation of antarctic crust and upper mantle using MAGSAT and other geophysical data [E84-10055] N84-15627
Magnetic anomalies in east Pacific using MAGSAT data [E84-10060] N84-15630
Geophysical data from drifting ice stations FRAM 4 and TRISTEN [AD-A133370] N84-15640

GEOMETRICAL THEORY OF DIFFRACTION
Radiation patterns of an antenna mounted on the mid-section of an ellipsoid [AD-A133203] N84-15365

GEOMETRY
The GPRIME approach to finite element modeling N84-15594
Orthotropic hole element N84-15595

GEOPHYSICS
Geophysical data from drifting ice stations FRAM 4 and TRISTEN [AD-A133370] N84-15640

GEOSYNCHRONOUS ORBITS
Capture-ejector satellites [NASA-TM-85686] N84-15179
The harmonic structure of PC 3-4 magnetic pulsations at geosynchronous orbit and its relation to the solar wind N84-16106

GEOTHERMAL TECHNOLOGY
Two-phase flow studies [DE84-001727] N84-15511

GLASS
Relationship between the glass transition temperature and the chemical structure of polymers [RAE-LIB-TRANS-2098] N84-15265
Volume recovery in glasses: A free-volume diffusion process [DE83-013771] N84-15280
A measurement of the response of an SCG1-C scintillation glass shower detector to 2-17.5 GeV positrons N84-15930

GLASS FIBER REINFORCED PLASTICS
Rubber-modified epoxy and glass laminates for application to naval ship structures [AD-A133305] N84-15204
The preparation and properties of porous glass-polymer composite N84-15261

GLIDERS
Wind tunnel investigations of glider fuselages with different waistings and wing arrangements N84-15116

GLOBAL ATMOSPHERIC RESEARCH PROGRAM
FGGE/SBUV tape specification and shipping letter description [NASA-CR-170482] N84-16071
FGGE/ERBM tape specification and shipping letter description [NASA-CR-170547] N84-16072
FGGE/ERBZ tape specification and shipping letter description [NASA-CR-170548] N84-16073

GLOBAL POSITIONING SYSTEM
Engineering evaluations and studies. Volume 2: Exhibit B, part 2 [NASA-CR-171726] N84-15176

GLYCEROLS
Polymer characterization by electrohydrodynamic ionization mass spectrometry: Probing composition and chemistry of mixtures in solution N84-15264

GOLD
The unique surface properties of gold N84-15310

GOLD ALLOYS
Moessbauer spectroscopy study of amorphous Fe87B11Au2 ribbon and its crystallization products [DE83-018091] N84-16010

GOLD COATINGS
The unique surface properties of gold N84-15310

GRADIENTS
An investigation of the use of iterative linear equation solvers in codes for large stiff systems of ODE's [AD-A133189] N84-15845

GRAIN BOUNDARIES
Grain boundary segregation and cavity formation in creep embrittled Cr-Mo steels N84-15320

GRAPH THEORY
The travelling salesman problem in graphs with 3-edge cutsets [AD-A133504] N84-15852

GRAPHITE-EPOXY COMPOSITES
Static and dynamic stiffness reduction of graphite/epoxy composite laminates under fatigue loading N84-15194
Analysis of local delaminations and their influence on composite laminate behavior [NASA-TM-85728] N84-15199
The effect of environment on the mechanical behavior of AS/3501-6 graphite/epoxy material [AD-A133331] N84-15205
Biaxial fatigue of graphite/epoxy + or - 45 sub s tubes N84-15210
Finite element analysis of moisture and external loading effects in composites N84-15211
Mechanical property characterization of F-100/934 graphite-epoxy composite material N84-16031
Stiffness properties for dynamic modeling of composite graphite-epoxy cylindrical orthotropic shells N84-16054

GRAPHS (CHARTS)
The long term upper ocean study (LOTUS). Cruise summary and hydrographic data report, ENDEAVOR 97, April 1983 [AD-A134005] N84-15745
The travelling salesman problem in graphs with 3-edge cutsets [AD-A133504] N84-15852

GRAVITATION
Synthesis of regional crust and upper-mantle structure from seismic and gravity data [E84-10061] N84-15631

GRAVITATIONAL WAVES
Electromagnetic, gravitational, and neutrino waves in flat and curved spacetime N84-16111

GRAVITY ANOMALIES
Two stochastic modeling problems in communications and navigation [AD-A133458] N84-15873

GRAVITY WAVES
F-region variability and HF-propagation N84-15658
The nature of microwave backscattering from water waves N84-15665
Numerical simulations of convectively excited gravity waves [DE84-001867] N84-15718
Ocean temperature changes induced by tropical cyclones N84-15722

GRAZING INCIDENCE
Technical support for AXAF [NASA-CR-170950] N84-15959

GREEN FUNCTION
Nonlinear Green's function method for transonic potential flow N84-15104

GREENHOUSE EFFECT
Response to W. W. Kellogg carbon dioxide and climatic change: Implications for mankind's future [DE84-002723] N84-15737

GRINDING MILLS
New profilable bond system for diamond and CBN grinding wheels [CSIR-TRANS-1707] N84-15294

GROUND EFFECT (AERODYNAMICS)
A study of helicopter rotor aerodynamics in ground-effect at low speeds N84-15106

GROUND TRUTH
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data [E84-10068] N84-15637

GROUP DYNAMICS
Influences on group productivity. 2: Factors inherent in the person. A bibliographic synopsis
[AD-A131015] N84-15790
Organizational-climate dimensions: A conceptual and judgmental analysis
[AD-A132898] N84-16068
GROUP 4B COMPOUNDS
Chemical vapor deposition of group IVB, VB, and VIB elements with nonmetals. A literature review
[PB83-225409] N84-15228
GROUP 5B COMPOUNDS
Chemical vapor deposition of group IVB, VB, and VIB elements with nonmetals. A literature review
[PB83-225409] N84-15228
GROUP 6B COMPOUNDS
Chemical vapor deposition of group IVB, VB, and VIB elements with nonmetals. A literature review
[PB83-225409] N84-15228
GUNS (ORDNANCE)
Capabilities of the NRCC/NAE flight impact simulator facility
[AD-A130849] N84-15136
GUST LOADS
Worldwide experience of wind shear during 1981-1982 N84-15087
Some comments on the hazards associated with manoeuvring flight in severe turbulence at high speed and low altitude N84-15089
GUSTS
Investigation of the arc cloud complex N84-16029
GYRES
Short-term measurements of surface currents associated with the Alboran Sea during Donde Va?
[AD-A133812] N84-15750
GYROSCOPES
All-fiber gyroscope with optical-Kerr-effect compensation N84-15518

H

HADRONS
Detectors at 20 TeV and detector considerations for a high luminosity hadron-hadron machine N84-15920
Track chambers for high luminosity N84-15921
The design and expected performance of a fast scintillator hadron calorimeter N84-15926
Prospects for Cerenkov ring imaging at hadron colliders N84-15934
TOF for heavy stable particle identification N84-15936
HAFNIUM OXIDES
Electrical conductivities of polycrystalline and single-crystal Er2O3-stabilized hafnia
[DE83-017681] N84-15279
HALF SPACES
Introduction to the FORTRAN 14 programs Duvorol and Contact for the solution of 3 D elastostatic half-space contact problems with and without friction
[PB83-147421] N84-15833
HANG GLIDERS
Aerodynamics, aeroelasticity, and stability of hang gliders N84-15134
HARDENING (MATERIALS)
Fracture resistance of hardened and tempered pipes of 16GFR steel
[BLL-M-35268-(5828.4)] N84-15584
HARDWARE
Computer science and technology: Future information processing technology, 1983
[PB83-257618] N84-15820
Space telescope
[NASA-CR-170948] N84-16097
HARMONIC ANALYSIS
Prototype tidal data analysis for Mississippi Sound and adjacent areas
[AD-A134071] N84-15744
HARMONIC OSCILLATION
The harmonic structure of PC 3-4 magnetic pulsations at geosynchronous orbit and its relation to the solar wind N84-16106
HAZARDS
State-of-the-Art for assessing earthquake hazards in the United States. Report 20: The contribution of directivity focusing to earthquake intensities
[AD-A132893] N84-15716
HEAO 1
X-ray observations of cataclysmic variables N84-16084
HEAT ACCLIMATIZATION
Heat exchange following atropine injection before and after heat acclimation
[AD-A132618] N84-15780
HEAT EXCHANGERS
A small and light weight heat exchanger for on-board helium refrigerator N84-15339
Evaluation of air-cooled central receivers
[DE83-005130] N84-15423
HEAT FLUX
Thermal analysis research applicable to space station technology needs
[NASA-TM-84658] N84-15426
HEAT MEASUREMENT
Experience of the axial field spectrometer at the CERN ISR N84-15912
Review of properties of various types of calorimeters: High luminosity and high energy N84-15917
Scintillators and waveshifters for fast scintillator-WSB calorimetry N84-15929
Calorimetry at L = 10/sup 33 N84-15931
Operation of a high-P/sub T spectrometer arm at 10/sup 33 cm-2 sec-1 with particle identification N84-15937
Muons and electrons in general N84-15938
HEAT RESISTANT ALLOYS
Arc spray fabrication of metal matrix composite monotape --- high temperature fiber-reinforced superalloy composites
[NASA-CASE-LEW-13828-1] N84-15203
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246
Elevated temperature low cycle fatigue of nickel base superalloys in the conventionally cast, directionally solidified and single crystal forms
[AD-A133598] N84-15253
HEAT STORAGE
High-temperature molten salt thermal energy storage systems for solar applications
[NASA-CR-167916] N84-15679
USAF advanced terrestrial energy study. Volume 3: Parameter survey
[AD-A133501] N84-15685
Heat-storage materials for IRCM
[AD-A133110] N84-15961
HEAT TRANSFER
An application of gap regenerator/expander precooled by two stage G-M refrigerator N84-15337
Fully coupled calculation of fluid flows with limited use of computer storage
[DE84-002218] N84-15508
Numerical solution to the steady state equation of transfer in azimuthally symmetric geometries --- heat transfer and molecular flow
[DE84-001781] N84-15509
An experimental study of steady and pulsating heat transfer in curved tubes N84-15515
Acoustical modes of arbitrary volumes using NASTRAN transient heat transfer RF9 N84-15597
Direct steam generation in line-focus solar collectors
[DE83-006030] N84-15678
Heat transfer retardation at elevated temperatures. Phase 1: Analysis of heat transfer retardation configurations and materials
[AD-A133509] N84-16017
HEAT TRANSMISSION
Theoretical and empirical terrestrial heat flow studies N84-15696
HEAT TREATMENT
Diffusion films produced by heat treatment of electroplated coatings
[BLL-OA-TRANS-3082-(6196.3)] N84-15237
Superconducting properties of Nb3Sn multifilamentary wires fabricated by internal tin process
[DE83-018189] N84-16011
HEATING
Heat generation in aircraft tires under braked rolling conditions
[NASA-CR-3768] N84-15587
The causation and variability of the northern winter quasi-stationary planetary waves N84-15705
Thermal electron heating rate: A derivation
[NASA-TM-85124] N84-15941
HEAVY IONS
Improved four-stage accel-decel production of low-energy stripped heavy ions
[DE83-005791] N84-15908
HEAVY NUCLEI
Giant dipole resonances built on excited states
[DE84-001549] N84-15954
HELICAL FLOW
A study of accretion in compact sources: Disk precession and jet helicity N84-16038
HELICOPTER DESIGN
Helicopter blade tips
[NASA-TM-77370] N84-15119
HELICOPTER PERFORMANCE
Helicopter blade tips
[NASA-TM-77370] N84-15119
HELICOPTERS
Research towards and development of aerospace vehicle noise certification with emphasis on propeller aircraft and helicopters N84-15026
Helicopter noise N84-15027
Army helicopter crashworthiness N84-15090
A study of helicopter rotor aerodynamics in ground-effect at low speeds N84-15106
HELIUM
High resolution ultraviolet laser spectroscopy of mercury and helium N84-15214
An application of gap regenerator/expander precooled by two stage G-M refrigerator N84-15337
Compact Claude cycle refrigerator for laboratory use N84-15338
A small and light weight heat exchanger for on-board helium refrigerator N84-15339
On 3He bolometer systems
[NASA-CR-175325] N84-15520
A report on superfluid helium flow through porous plugs for space science applications N84-16043
HELMHOLTZ VORTICITY EQUATION
Elliptic solvers for NORDA ocean models and a quasi-geostrophic regional eddy-mean energetics package
[AD-A133754] N84-15751
HEMISPHERE CYLINDER BODIES
Millimeter wave guiding structures and antennas
[AD-A133528] N84-15376
HERMETIC SEALS
Fabrication of a hermetically sealed connector
[DE84-002322] N84-15402
HETEROGENEITY
The heterogeneous nucleation of ice I N84-15325
Lateral heterogeneity and azimuthal anistropy of the upper mantle: Love and Rayleigh waves 100-250 sec
[NASA-CR-174619] N84-15710
Influences on group productivity. 2: Factors inherent in the person. A bibliographic synopsis
[AD-A131015] N84-15790
HEXAGONS
Aperture efficiency considerations in the convolution synthesis of symmetrical hexagonal arrays
[AD-A133367] N84-15369
HIGH ALTITUDE
Design considerations for remotely piloted, high-altitude airplanes powered by microwave energy
[NASA-TM-85730] N84-15145
HIGH ALTITUDE BREATHING
Increased metabolism and dead space as components of ventilation at high altitude
[AD-A130827] N84-15766
Variable inhibition by falling CO2 of hypoxic ventilatory response in man
[AD-A130658] N84-15768
HIGH DISPERSION SPECTROGRAPHS
Operation of a high-P/sub T spectrometer arm at 10/sup 33 cm-2 sec-1 with particle identification N84-15937
HIGH ENERGY INTERACTIONS
Monte Carlo simulation of high p/sub P jets N84-15915
The problem of tracking charged particles in the cores of high energy jets in a high rate environment N84-15916
Review of properties of various types of calorimeters: High luminosity and high energy N84-15917
Trigger systems which could operate at a luminosity of 10/sup 33 cm(-2) to sec/sup -1 N84-15918
Angular coverage of detectors N84-15940
HIGH FREQUENCIES
Confidence region for the evaluation of HF DF single site location systems
[AD-A133208] N84-15140
F-region variability and HF-propagation N84-15658
Determination of propagation limitations at HF by real-time update of a computer model from oblique sounder data N84-15660
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15661
Interpretation of near-source ground motion and implications N84-15697
HIGH PRESSURE
Structural studies at elevated pressure and reduced temperatures using synchrotron radiation: Application to Ce.8La.1Th.1
[DE84-001793] N84-16007
HIGH RESOLUTION
High resolution ultraviolet laser spectroscopy of mercury and helium N84-15214
The CARS spectroscopy in a supersonic jet N84-15216
Experience in surface analysis applied to technical material problems N84-15303
Design, construction, and use of a high-resolution, two-component LDA N84-15419

HIGH SPEED
Some comments on the hazards associated with manoeuvring flight in severe turbulence at high speed and low altitude N84-15089
HIGH TEMPERATURE GASES
Fluid shielding of high-velocity jet noise
[NASA-TP-2259] N84-15894
HIGH TEMPERATURE PLASMAS
Drift waves in rotating plasmas
[DE84-000391] N84-15988
HIGH TEMPERATURE TESTS
Trichite growth during oxidation of titanium and TA6V4 alloy by water vapor at high temperatures
[NASA-TM-76974] N84-15248
HILBERT SPACE
Geometric methods for linear prediction --- signal processing
[FUB-54-1982] N84-15859
HINGES
Bending elasticity of circularly notched bars as monolithic flexure hinges in precision mechanisms
[DE84-002199] N84-15612
HISTORIES
A guide to research in NASA history, 7th edition
[NASA-TM-85486] N84-16076
HODOSCOPES
High energy electromagnetic shower position measurement by a fine grained scintillation hodoscope N84-15928
HOLDERS
Appropriate lengths between phalanges of multijointed fingers for stable grasping
[AD-A133448] N84-15806
HOLE GEOMETRY (MECHANICS)
Orthotropic hole element N84-15595
HOMOGENEOUS TURBULENCE
Improved turbulence models based on large eddy simulation of homogeneous, incompressible turbulent flows N84-15514
HORN ANTENNAS
Earth coverage corrugated horns (44.5 GHz and 20.7 GHz)
[AD-A133241] N84-15366
HOT ELECTRONS
Radial structure of curvature-driven instabilities in hot-electron plasma
[DE84-002256] N84-15966
HOT-FILM ANEMOMETERS
The structure of turbulent entraining flow in an annulus with a rotating screen N84-15416
HOUSINGS
Advanced high-power generator for airborne applications
[AD-A133290] N84-15396
HUMAN BEHAVIOR
Neurobehavioral effects of carbon monoxide (CO) exposure in humans protocol 1
[AD-A133691] N84-15774
Job attitudes toward the new maintenance concept of the airway facilities service
[AD-A133282] N84-15793
The human side of robotics: Results from a prototype study on how workers react to a robot
[AD-A133438] N84-15805
HUMAN BEINGS
Exposure chamber for studies of pollutant gases and aerosols in human subjects: Design considerations
[DE84-001135] N84-15785
HUMAN BODY
Experiments on factors that influence muscular function in man
[AD-A133928] N84-15771
Development of an interactive computer program to produce body description data
[AD-A133720] N84-15822
HUMAN CENTRIFUGES
Crew station evaluation in a dynamic flight simulation facility N84-15069
HUMAN FACTORS ENGINEERING
Avionics/crew station integration N84-15042
Combined visualization N84-15043
Guidelines and criteria for the functional integration of avionic systems with crew members in command N84-15044
New flight deck design in the light of the operational capabilities N84-16097
Certification experience with methods for minimum crew demonstration N84-15101
Pilot human factors in stall/spin accidents of supersonic fighter aircraft N84-15102
HUMAN PERFORMANCE
Incident reporting: Its role in aviation safety and the acquisition of human error data N84-15081
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
Color perception and ATC job performance
[AD-A132649] N84-15781
Rate of initial recovery and subsequent radar monitoring performance following a simulated emergency involving startle
[AD-A133602] N84-15795
Evaluation results for the interactive video competency recognition system
[AD-A133052] N84-15796
Applied psychology in Europe: An ONR perspective
[AD-A133093] N84-15797
Artificial intelligence: An analysis of potential applications to training, performance measurement, and job performance aiding
[AD-A133592] N84-15839
Performance appraisal revisited
[AD-A132841] N84-16059
Incentives for controlling the performance of high technology and professional employees
[AD-A134074] N84-16061
Organizational outcomes of creativity
[AD-A132825] N84-16066
The design of effective reward systems
[AD-A132859] N84-16067
HUMAN REACTIONS
Job attitudes toward the new maintenance concept of the airway facilities service
[AD-A133282] N84-15793
Rate of initial recovery and subsequent radar monitoring performance following a simulated emergency involving startle
[AD-A133602] N84-15795
The human side of robotics: Results from a prototype study on how workers react to a robot
[AD-A133438] N84-15805
HYDRATION
Raman measurements of the mobile cation vibrations in Na, K, Ag and Li (ALPHA)'-alumina
[DE83-015697] N84-16005
HYDRAULIC FLUIDS
Inhalation toxicology. 3: Evaluation of thermal degradation products from aircraft and automobile engine oils, aircraft hydraulic fluid, and mineral oil
[AD-A133221] N84-15778
HYDRIDES
LaNi5 hydride cryogenic refrigerator test results N84-15350
HYDROCARBON FUELS
Atomization and mixing study
[NASA-CR-170943] N84-15426
HYDRODYNAMICS
Comparison of steady state transitions in truncated spectral and finite difference models of two-dimensional shallow convection N84-15417
Two-phase flow studies
[DE84-001727] N84-15511
Interactive mechanisms of sliding-surface bearings
[AD-A133127] N84-15556
Alternative experiments using the geophysical fluid flow cell
[NASA-CR-3766] N84-15706
Program in marine physics applied to Navy undersea missions
[AD-A133119] N84-15753
Problems in astrophysical radiation hydrodynamics
[DE84-000185] N84-16102
HYDROGEN
Quantitative determination of hydrogen by pulsed nuclear magnetic resonance spectroscopy
[DE84-002831] N84-15227
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246
Effects of hydrogen on strength and ductility of tantalum N84-15260
Kinematics of the structure and morphology during surface reactions between transition metals and molecular hydrogen N84-15317
Use of scanning electron microscopy in studying surface reactions of metals with hydrogen N84-15318
An experimental investigation of the structure of a turbulent reattaching flow behind a backward-facing step N84-15415
Vacuum ultraviolet photofragmentation of H2O and NO2: Laboratory studies and atmospheric applications N84-15703
Investigation of a para-ortho hydrogen reactor for application to spacecraft sensor cooling
[NASA-CR-175131] N84-15957
Part 1: Physical studies of distant comets. Part 2: Morphologies of planetary nebulae N84-16091
HYDROGEN EMBRITTLEMENT
The nature of quasicleavage fracture in tempered 5.5 ni steel after hydrogen charging
[AD-A133460] N84-15252
HYDROGEN PEROXIDE
State-to-state unimolecular reaction dynamics
[DE84-003009] N84-15952
HYDROGEN PLASMA
Hydrogen ignition for laser propulsion N84-16026
HYDROMETALLURGY
Precipitation of metals from solutions by baser metals
[CSIR-1712] N84-15242
HYPERBOLIC DIFFERENTIAL EQUATIONS
Explicit second order splitting schemes for solving hyperbolic nonlinear problems: Theory and application to transonic flow
[ESA-TT-768] N84-15855
HYPOTHALAMUS
Neuronal adaptive mechanisms underlying intelligent information processing
[AD-A133694] N84-15776
HYPOXIA
Variable inhibition by falling CO2 of hypoxic ventilatory response in man
[AD-A130658] N84-15768

I

ICE
Aerostat icing problems
[AD-A133403] N84-15272
Stress measurements in ice
[AD-A133906] N84-15609
ICE FLOES
Snow thickness and brightness temperature on multi-year ice
[AD-A133940] N84-15747
ICE FORMATION
Rotorcraft icing technology: An update N84-15084
Ice formation in aircraft N84-15130
Aerostat icing problems
[AD-A133403] N84-15272
The heterogeneous nucleation of ice I N84-15325
Geophysical data from drifting ice stations FRAM 4 and TRISTEN
[AD-A133370] N84-15640
ICE MAPPING
HF over-the-horizon mapping of the Greenland icecap N84-15654
IDEAL FLUIDS
Computational methods for ideal compressible flow N84-15462
IDENTIFYING
Rapid identification of micro-organisms
[AD-A132831] N84-15759
IFF SYSTEMS (IDENTIFICATION)
Integration of ICNIA into advanced high performance fighter aircraft N84-15059
IGNITION
Chemical kinetics modeling of engine knock: Preliminary results
[DE84-001236] N84-15226
Unconfined gas explosions --- conferences
[VKI-LS-1983-02] N84-15438
Identification of problem areas --- unconfined gas explosions N84-15440
Hydrogen ignition for laser propulsion N84-16026
ILLUMINATING
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
ILLUMINATION
Effect of UV illumination on the sublimation of basal surfaces of zinc oxide
[AD-A133383] N84-15222
IMAGE ANALYSIS
Thematic mapper radiometric variability on ostensibly uniform agricultural scenes
[E84-10035] N84-15626
Spatial reasoning to determine stream network from LANDSAT imagery
[E84-10063] N84-15632
A representation for shape based on peaks and ridges in the difference of low-pass transform
[AD-A133299] N84-15849
IMAGE ENHANCEMENT
Edge- and contour detection for correction of low-pass filtered images
[PB83-217489] N84-15969
IMAGE INTENSIFIERS
Nanosecond image-shuttering studies at Los Alamos National Laboratory
[DE84-001733] N84-15405
Interfacing a two-stage image intensifier tube to an echelle spectrograph N84-16035

IMAGE PROCESSING
Experimental techniques for free edges of turbulent flows N84-15450
Image understanding research and its application to cartography and computer-based analysis of aerial imagery
[AD-A133495] N84-15642
POPEYE: A gray-level vision system for robotics applications
[AD-A133296] N84-15804
A representation for shape based on peaks and ridges in the difference of low-pass transform
[AD-A133299] N84-15849
Application of the Gibbs distribution to image segmentation
[AD-A133406] N84-15850
Low-ionization emission regions in the nuclei of spiral galaxies N84-16100
IMAGE RESOLUTION
Landsat 4 TM-data: Examples of resolution capacity
[FOA-C-30329-E1] N84-15844
IMAGE TUBES
Interfacing a two-stage image intensifier tube to an echelle spectrograph N84-16035
IMAGING TECHNIQUES
Voyager observations of Saturn's rings. 1: The eccentric rings at 1.29, 1.45, 1.95 and 227 Rs N84-16087
IMIDES
Phosphorous-containing imide resins — flame resistant composite materials
[NASA-CASE-ARC-11368-3] N84-15202
IMMOBILIZATION
Immobilization of biomolecules on semiconductor surfaces
[FOA-C-40178-C2(B2,A3)] N84-15406
IMPACT RESISTANCE
Army helicopter crashworthiness N84-15090
IMPACT TESTS
Investigations on the reproducibility of the results of drop weight tests by the method of W. S. Pellini
[BLL-DRIC-T-6970-(3623.66)] N84-15517
IMPEDANCE
Beam current limitations due to instabilities in modified and conventional betatrons
[AD-A133337] N84-15947
IMPULSE GENERATORS
Second-order adaptive infinite impulse response filter
[DE84-001768] N84-15406
IMPURITIES
Control of impurities in the epitaxial growth of high quality GaAs
[AD-A133187] N84-15996
INCENTIVE TECHNIQUES
The design of effective reward systems
[AD-A132859] N84-16067
INCENTIVES
The design of effective reward systems
[AD-A132859] N84-16067
INCOMPRESSIBLE BOUNDARY LAYER
Instability and transition in the boundary layer N84-15516
INCOMPRESSIBLE FLOW
An assumed deviatoric stress-velocity-pressure mixed finite element method for unsteady convective, incompressible viscous flow N84-15420
Finite-difference approximations of the Navier-Stokes equations for incompressible flows N84-15434
Improved turbulence models based on large eddy simulation of homogeneous, incompressible turbulent flows N84-15514
Instability and transition in the boundary layer N84-15516
INDEXES (DOCUMENTATION)
Simulated precipitation reference materials, 4
[PB83-139378] N84-15742
INDIAN OCEAN
Tropical cyclone operational plan for the Southwest Indian Ocean
[WMO-618] N84-15741
INDIUM
Field emission electric propulsion: Additional propellants: Further tests on indium and alloys
[R664] N84-15186
INDIUM ALLOYS
Field emission electric propulsion: Additional propellants: Further tests on indium and alloys
[R664] N84-15186
INDIUM ARSENIDES
InAsSb strained-layer superlattices for long wavelength detector applications
[DE84-001055] N84-16004
An In0 2Ga0 8As/GaAs, modulation-doped, strained-layer superlattice field-effect transistor
[DE84-000136] N84-16006
INDOOR AIR POLLUTION
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
INDUCTION HEATING
Influence of alloying on the properties of nickel in the solid and liquid states
[BLL-M-35284-(5628.4)] N84-15232
INDUCTION MOTORS
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
INERTIAL NAVIGATION
Two stochastic modeling problems in communications and navigation
[AD-A133458] N84-15873
INERTIAL UPPER STAGE
Engineering evaluations and studies. Volume 1: Exhibit A
[NASA-CR-171724] N84-15174
An evaluation of Techroll seal flexible joint material N84-16037
INFERENCE
Ambiguity and uncertainty in probabilistic inference
[AD-A133418] N84-15872
INFINITY
Second-order adaptive infinite impulse response filter
[DE84-001768] N84-15406
INFORMATION DISSEMINATION
Effective use of earthquake data
[AD-A134077] N84-15712
Computer science and technology: Future information processing technology, 1983
[PB83-257618] N84-15820
INFORMATION FLOW
Effective use of earthquake data
[AD-A134077] N84-15712
INFORMATION MANAGEMENT
Joint Atomic Information Exchange Group information management project. Task 2 briefing document. System specification and hardware/software purchase recommendations for JAIEG automated information management system
[DE84-001798] N84-16083
INFORMATION RETRIEVAL
Computer science and technology: Future information processing technology, 1983
[PB83-257618] N84-15820
Computer-Output Microfiche (COM) on the Oak Ridge computer network
[DE84-002422] N84-15836
A new treatment of incomplete information and retrieval in relational data bases N84-16069
An interactive soils information system. Users manual
[AD-A133480] N84-16078
Research topics in statistical database management
[DE84-002581] N84-16080
INFORMATION SYSTEMS
Effective use of earthquake data
[AD-A134077] N84-15712
Appraisal of scientific resources for emergency management
[AD-A133285] N84-16062
A new treatment of incomplete information and retrieval in relational data bases N34-16069
The perceptual component of relationships in library networks N84-16070
Local automation model: Functional description
[AD-A133389] N84-16077
An interactive soils information system. Users manual
[AD-A133480] N84-16078
Joint Atomic Information Exchange Group information management project. Briefing outlining functions and specifications of JAIEG automated information management system
[DE84-001800] N84-16082
Joint Atomic Information Exchange Group information management project. Task 2 briefing document. System specification and hardware/software purchase recommendations for JAIEG automated information management system
[DE84-001798] N84-16083
INFORMATION THEORY
Performance characteristics of passive coherence estimators
[AD-A133209] N84-15396
Exploiting temporal knowledge to organize constraints
[AD-A133417] N84-15838
Maximum entropy linear prediction method
[FUB-48-1982] N84-15857
Linear prediction methods — signal processing
[FUB-52-1982] N84-15858
INFRARED ASTRONOMY
A report on superfluid helium flow through porous plugs for space science applications N84-16043
INFRARED ASTRONOMY SATELLITE
JPL closeup
[NASA-CR-175324] N84-15166
INFRARED DETECTORS
On 3He bolometer systems
[NASA-CR-175325] N84-15520
INFRARED INSPECTION
Feasibility of thermal NDE methods for Naval thermal spray coatings
[DE84-001463] N84-15569
INFRARED RADAR
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15651
INFRARED RADIATION
Design of an adiabatic demagnetization refrigerator for studies in astrophysics N84-15352
INFRARED SCANNERS
Testing and characterizations of infrared sensor over the temperature range of 2 Kelvin to 300 Kelvin N84-15347
Feasibility of thermal NDE methods for Naval thermal spray coatings
[DE84-001463] N84-15569
INFRARED SPECTRA
Development of visible/infrared/microwave agriculture classification and biomass estimation algorithms, volume 2 — Oklahoma and Texas
[E84-10059] N84-15629
Clear atmospheric effects on insolation illustrated by broad-band radiometer measurements N84-15701
Observations of the unidentified 3.3 microns emission feature in compact HII regions N84-16089
INFRARED SPECTROMETERS
Far Infrared Radiometric Spectrometer (FIRRS)
[AD-A133552] N84-15527
Diode laser spectrophotometry for monitoring acetylene on-line in a liquefaction plant
[DE84-002117] N84-15548
INFRARED SPECTROPHOTOMETERS
Development of quantitative infrared analysis for monitoring water and emulsifying agents in fire-resistant microemulsion diesel fuels
[AD-A133242] N84-15286
INFRARED STARS
Infrared measurements of AFGL (Air Force Geophysics Laboratory) sources
[AD-A133553] N84-16098
INGESTION (ENGINES)
FOD (Foreign Object Damage) generation by aircraft tires — probability of engine ingestion and airfield surface movements
[AD-A133319] N84-15146
INHOMOGENEITY
Multiple scattering from a random and inhomogeneous slab N84-15624
INJECTORS
Atomization and mixing study
[NASA-CR-170943] N84-15428
INLET FLOW
Inlet flow field investigation. Part 1: Transonic flow field survey
[NASA-CR-172239] N84-15123
Broad specification fuels combustion technology program
[NASA-CR-168179] N84-15283
INORGANIC CHEMISTRY
Activities of the National Chemical Research Laboratory
[CSIR-SR-CHEM-261] N84-15188
INPUT
Dynamic control of session input rates in communication networks
[AD-A133572] N84-15379
INPUT/OUTPUT ROUTINES
Performance characteristics of passive coherence estimators
[AD-A133209] N84-15396
Input-output characterization of an ultrasonic testing system by digital signal analysis
[NASA-CR-3756] N84-15565
INSOLATION
Clear atmospheric effects on insolation illustrated by broad-band radiometer measurements N84-15701
INSPECTION
Elastomeric impression materials and cleaning systems for residue removal
[RFP-3442] N84-15296
Automatic inspection for printed wiring
[AD-A133328] N84-15566
INSTRUCTION SETS (COMPUTERS)
Processing time using Datatrieve-11, clunks, and FORTRAN
[DE84-001706] N84-16081
INSTRUMENT COMPENSATION
All-fiber gyroscope with optical-Kerr-effect compensation N84-15518

INTEGRAL EQUATIONS
Computation of steady internal flows using integral representation methods with finite series expansions N84-15418
Least-square iterative techniques for solving integral equations
[PB83-166751] N84-15864
Elements of functions of a complex variable N84-15881

INTEGRATED CIRCUITS
Proceedings of Symposium on Surface Science and its Industrial Implications
[ISBN-0-7988-2417-4] N84-15298
Integrated circuit failure mechanism detected by IMMA N84-15305
Organometallic epitaxy for GaAs/AlGaAs microwave transistors and integrated circuits
[AD-A133569] N84-16001
Logic simulator program N84-16023

INTERFACES
Connecting aircraft and external loads N84-15046
AFTI/F-16: An integrated system approach to combat automation N84-15083
The man-machine interface in new generation commercial aircraft N84-15096
Numerical electromagnetics code. Method of moments. User's guide supplement for NEC-3 for modeling buried wires
[DE84-002195] N84-15382
Numerical methods for tracking interfaces
[DE84-001730] N84-15854
Problems at the interface between perturbative and nonperturbative quantum chromodynamics
[DE84-002375] N84-16018

INTERNAL COMBUSTION ENGINES
NAHBE (Naval Academy Heat Balanced Engine) m151 retrofit evaluation
[AD-A133475] N84-15559
Stirling engines with controlled evaporation of a two-phase two-component working fluid
[DE83-017284] N84-15560

INTERNAL WAVES
Lidar remote sensing of internal waves and optical properties N84-15670

INTERNATIONAL COOPERATION
Helix and Felix: Loading standards for use in the fatigue evaluation of helicopter rotor components
[NLR-MP-82041-U] N84-15149

INTERNATIONAL SUN EARTH EXPLORER 3
Plasma wave experiment for the ISEE-3 mission
[NASA-CR-175132] N84-15972

INTERPOLATION
Numerical electromagnetics code. Method of moments. User's guide supplement for NEC-3 for modeling buried wires
[DE84-002195] N84-15382
Practical three-dimensional mesh generation using transfinite interpolation N84-15463
Explicit multistage finite volume procedure to solve the Euler equations for transonic flow N84-15464

INTERPROCESSOR COMMUNICATION
Simulation requirements to support the development of a fault tolerant avionic system N84-15072
Advanced automation program. Program master plan
[DOT/FAA/AP-83/3] N84-15139
Advanced teleprocessing systems
[AD-A133554] N84-15377
A survey of network reliability
[AD-A133545] N84-15835
Analyzing the roles of descriptions and actions in open systems
[AD-A133614] N84-15878

INTERSTELLAR GAS
Interfacing a two-stage image intensifier tube to an echelle spectrograph N84-16035

INTERSTELLAR MATTER
Observations of the unidentified 3.3 microns emission feature in compact HII regions N84-16089
Infrared measurements of AFGL (Air Force Geophysics Laboratory) sources
[AD-A133553] N84-16098
Ambipolar diffusion in interstellar clouds: One-dimensional, isothermal collapse N84-16099
The interstellar medium along the line of sight toward X Per N84-16101

INTERSTITIALS
On the functional dependence of the freezing point of soils on the composition of water soluble salts in an interstitial solution
[NRC/CNR-TT-2070] N84-15707

INVENTORIES
Census of US Civil aircraft. Calendar year 1982
[AD-A133161] N84-15033

INVERSIONS
Determination of particle-size distribution by measuring the transmission of an aerosol in sedimentation
[AD-A133286] N84-15962

INVESTMENT CASTING
Low-cost single-crystal turbine blades, volume 1
[NASA-CR-168218] N84-15247

INVISCID FLOW
A lower-upper factored implicit scheme for the numerical solution of the Euler equations applied to arbitrary cascades N84-15111
Asymptotic theory of an unseparated supersonic turbulent boundary layer at a compression corner N84-15112

IODIDES
Development of a mercuric iodide solid state spectrometer for X-ray astronomy
[NASA-CR-175330] N84-16096

ION BEAMS
Ion plating in corrosion protection
[DE84-001182] N84-15256
Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy
[DE84-001985] N84-15257
Ion-beam analysis and ion implantation in the study of diffusion
[DE84-000354] N84-16008

ION EMISSION
Experimental studies of secondary ion emission from well-characterized surfaces
[AD-A133186] N84-15943

ION EXCHANGE RESINS
Analytical chemistry N84-15189

ION EXCHANGING
The heterogeneous nucleation of ice I N84-15325

ION IMPLANTATION
Ion-beam analysis and ion implantation in the study of diffusion
[DE84-000354] N84-16008

ION PLATING
Comparative study of TiN hard coatings produced by reactive sputtering, ion-plating and CVD technique
[BLL-RARDE-TR-1094(7291.7965)] N84-15236

ION PROPULSION
Field emission electric propulsion: Additional propellants: Further tests on indium and alloys
[R684] N84-15186

ION SCATTERING
Ion-beam analysis and ion implantation in the study of diffusion
[DE84-000354] N84-16008

IONIC MOBILITY
The effects of space charge on ionic mobility measurements in cylindrical geometries N84-15993

IONIZATION
Process for isotope separation
[DE84-001983] N84-15507
Simultaneous electron capture and excitation in ion-atom collisions
[DE83-005799] N84-15907
Determination of ionization rates in the principal crystallographic directions in silicon
[AD-A133513] N84-15999
Low-ionization emission regions in the nuclei of spiral galaxies N84-16100

IONIZATION CROSS SECTIONS
Data analysis and theoretical studies for atmospheric Explorer C, D and E
[NASA-CR-175121] N84-15711

IONIZING RADIATION
Duration of memory loss due to electron beam exposure
[AD-A132941] N84-15760

IONOGRAMS
Automatic electron density profiles from digital ionograms N84-15659
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15661

IONOSPHERE
Data analysis and theoretical studies for atmospheric Explorer C, D and E
[NASA-CR-175121] N84-15711

IONOSPHERIC DISTURBANCES
Propagation effects in satellite-borne synthetic aperture radars N84-15650
The Canadian programme of experimental measurement of sea-state characteristics by sky-wave radar N84-15657
F-region variability and HF-propagation N84-15658

IONOSPHERIC ELECTRON DENSITY
Ionospheric factors affecting the performance of HF sky-wave sea-state radars N84-15656
Automatic electron density profiles from digital ionograms N84-15659

IONOSPHERIC HEATING
Thermal electron heating rate: A derivation
[NASA-TM-85124] N84-15941

IONOSPHERIC PROPAGATION
Theoretical predictions for VLF radio propagation
[AD-A133168] N84-15364
Propagation effects in satellite-borne synthetic aperture radars N84-15650
Ionospheric factors affecting the performance of HF sky-wave sea-state radars N84-15656
The Canadian programme of experimental measurement of sea-state characteristics by sky-wave radar N84-15657
F-region variability and HF-propagation N84-15658
Automatic electron density profiles from digital ionograms N84-15659
Determination of propagation limitations at HF by real-time update of a computer model from oblique sounder data N84-15660
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15661

IONS
Emission of short-wavelength photons from ion-surface charge exchange
[AD-A133183] N84-15942
Collisional-radiative model for helium-like ions: Application to intermediate-density plasmas
[IPPJ-847] N84-15976
Nonlinear interaction of toroidicity induced drift modes
[DE84-001562] N84-15987
Energy distributions and yields of secondary ions and electrons emitted by GIOTTO during Halley encounter
[DE84-001661] N84-16105

IRON ALLOYS
Oxygen adsorption and initial oxidation of single crystal first row transition metal and alloy surfaces N84-15316
Moessbauer spectroscopy study of amorphous Fe67B11Au2 ribbon and its crystallization products
[DE83-018091] N84-16010

IRON COMPOUNDS
The chemistry of transition metal carbene complexes
[AD-A133541] N84-15225

IRRADIATION
Design and use of nonstandard tensile specimens for irradiated materials testing
[DE84-001468] N84-15254
Use of the disk bend test to assess irradiation performance of structural alloys
[DE84-001484] N84-15255

ISENTROPIC PROCESSES
Characterization of the pressure wave originating in the explosion of a gas cloud N84-15446

ISOTOPE SEPARATION
Process for isotope separation
[DE84-001983] N84-15507

ISOTROPISM
Numerical solution to the steady state equation of transfer in azimuthally symmetric geometries --- heat transfer and molecular flow
[DE84-001781] N84-15509

ISOTROPY
A study of the return to isotropy of homogeneous turbulence N84-15110

ITERATION
Reflection and transmission of electromagnetic waves at a rough interface between two different media
[PB83-217588] N84-15389
Subpicosecond-relaxation studies using tunable-laser-induced-grating techniques N84-15531
An investigation of the use of iterative linear equation solvers in codes for large stiff systems of ODE's
[AD-A133189] N84-15845
A local-relaxation method for solving convection-diffusion equations
[NLR-MP-82030-U] N84-15862

ITERATIVE SOLUTION
Iterative techniques for the solution of elliptic finite difference equations N84-15435
Iterative solution of the finite difference potential equations for subsonic and transonic flows N84-15436
Finite element methods for potential flows N84-15437
A survey of solution techniques for nonlinear finite element equations
[NLR-MP-82027-U] N84-15861
Least-square iterative techniques for solving integral equations
[PB83-166751] N84-15864

J

JAGUAR AIRCRAFT
Certification experience of the Jaguar fly-by-wire demonstrator aircraft integrated flight control system N84-15095

JAMMING
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371
Adaptive arrays for multiple simultaneous desired signals
[AD-A133486] N84-15373
Adaptive protection of detecion systems operating by spread spectrum N84-15652
Contending with jamming in decametric waves in an adaptive system of all-directional antennas N84-15653
A minimax theorem for antijamming group codes
[DFVLR-FB-83-30] N84-15879
JAPANESE SPACE PROGRAM
Fine pointing control of the solar UV telescope on the sounding rocket S-520-5
[ISAS-608] N84-16094
JET AIRCRAFT NOISE
Fluid shielding of high-velocity jet noise
[NASA-TP-2259] N84-15894
JET ENGINES
Study of noise-certification standards for aircraft engines. Volume 1: Noise-control technology for turbofan engines
[AD-A133386] N84-15157
JET EXHAUST
Fully-coupled analysis of jet mixing problems. Part 1. Shock-capturing model, SCIPVIS
[NASA-CR-3761] N84-15425
Fluid shielding of high-velocity jet noise
[NASA-TP-2259] N84-15894
JET MIXING FLOW
Fully-coupled analysis of jet mixing problems. Part 1. Shock-capturing model, SCIPVIS
[NASA-CR-3761] N84-15425
JET STREAMS (METEOROLOGY)
Baroclinic instability of atmospheric jets N84-15704
A comparison study of the energetics of standing and transient eddies between two general circulation models: The GLAS Climate Model and the NCAR Community Climate Model N84-15726
JOINTS (JUNCTIONS)
Nonlinear viscoelastic characterization of structural adhesives
[NASA-CR-172279] N84-15268
Appropriate lengths between phalanges of multijointed fingers for stable grasping
[AD-A133448] N84-15806
JOULE-THOMSON EFFECT
Cascade Joule-Thomson refrigerators N84-15354
Low cost microminiature refrigerators for large unit volume applications N84-15356
JUDGMENTS
Neurobehavioral effects of carbon monoxide (CO) exposure in humans protocol 1
[AD-A133891] N84-15774
Ambiguity and uncertainty in probabilistic inference
[AD-A133418] N84-15872

K

KANSAS
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data
[E84-10068] N84-15637
KERNEL FUNCTIONS
On jackknifing kernel regression function estimators
[AD-A133236] N84-15867
KERR ELECTROOPTICAL EFFECT
All-fiber gyroscope with optical-Kerr-effect compensation N84-15518
KINETIC ENERGY
A study of the return to isotropy of homogeneous turbulence N84-15110
A comparison study of the energetics of standing and transient eddies between two general circulation models: The GLAS Climate Model and the NCAR Community Climate Model N84-15726
KNOWLEDGE
Exploiting temporal knowledge to organize constraints
[AD-A133417] N84-15838

L

LAMINAR FLOW
Transport algorithms for methane flames
[AD-A133213] N84-15221
A finite difference technique for laminar and turbulent compressible boundary layers N84-15433
The effects of acoustic excitation on the mixing of two parallel laminar streams of fluid
[AD-A126788] N84-15502
LAMINATES
Recognizing defects in carbon-fiber reinforced plastics
[NASA-TM-76947] N84-15143
Analysis of local delaminations and their influence on composite laminate behavior
[NASA-TM-85728] N84-15199
Analysis of interlaminar stresses in thick composite laminates with and without edge delamination
[NASA-TM-85738] N84-15201
Rubber-modified epoxy and glass laminates for application to naval ship structures
[AD-A133305] N84-15204
Fatigue damage-strength relationships in composite laminates. Volume 1
[AD-A133485] N84-15206
Composite laminate weight optimization on the HX-20
[AD-A133490] N84-15207
Biaxial fatigue of graphite/epoxy + or - 45 sub s tubes N84-15210
Stiffness properties for dynamic modeling of composite graphite-epoxy cylindrical orthotropic shells N84-16054
LAND USE
Analysis of data acquired by synthetic aperture radar over Dade County, Florida, and Acadia Parish, Louisiana
[E84-10067] N84-15636
LANDING GEAR
Preflight transient dynamic analyses of B-52 aircraft carrying Space Shuttle solid rocket booster drop-test vehicle
[NASA-TM-84925] N84-15588
LANDSAT SATELLITES
Use of LANDSAT MSS (multispectral scanner) digital data in water quality mapping of the Neuse River estuary, North Carolina
[PB83-256750] N84-15645
LANDSAT 4
Thematic mapper radiomtric variability on ostensibly uniform agricultural scenes
[E84-10035] N84-15626
In-flight absolute radiometric calibration of the thematic mapper
[E84-10064] N84-15633
Spectral characterization of the LANDSAT thematic mapper sensors
[E84-10065] N84-15634
Landsat 4 TM-data: Examples of resolution capacity
[FOA-C-30329-E1] N84-15644
LAPLACE TRANSFORMATION
An approach to logistic problems by the L-transform method N84-15884
LARGE SCALE INTEGRATION
Logic simulator program N84-16023
LARGE SPACE STRUCTURES
ACOSS Fourteen (Active Control of Space Structures)
[AD-A133411] N84-15181
Direct multivariable model reference adaptive control with applications to large structural systems N84-15840
Finite element analysis of a deployable space structure N84-16056
LARGE SPACE TELESCOPE
Space telescope
[NASA-CR-170948] N84-16097
LASER ALTIMETERS
Analysis of short pulse laser altimetry data obtained over horizontal path
[NASA-CR-170612] N84-15535
LASER APPLICATIONS
Design, construction, and use of a high-resolution, two-component LDA N84-15419
LASER CAVITIES
A low loss quasioptical cavity for a two-stage Free Electron Laser (FEL)
[AD-A133321] N84-15541
Coherently pumped two-frequency laser-type devices
[AD-A133439] N84-15545
Two-stage FEL (Free Electron Laser) program
[AD-A133508] N84-15546
LASER DOPPLER VELOCIMETERS
Flow visualization and LDV measurement of turbulent mixing layers
[REPT-806] N84-15424
LASER INTERFEROMETRY
Advanced techniques of laser telemetry N84-15883
LASER MODES
A low loss quasioptical cavity for a two-stage Free Electron Laser (FEL)
[AD-A133321] N84-15541
LASER OUTPUTS
On laser air breakdown, threshold power and laser generated channel length
[AD-A133211] N84-15538
Application of two-dimensional discrete-ordinates methods to multiple scattering of laser radiation
[AD-A133258] N84-15539
Limiting energy spread at high laser intensities using phase space displacement
[AD-A133322] N84-15542
Copper vapor laser scale demonstration
[AD-A133327] N84-15543
Variation of laser absorption with plasma scalelength in long-scalelength plasmas
[DE84-002743] N84-15991
LASER PLASMAS
Development of an XUV amplifier N84-15532
On laser air breakdown, threshold power and laser generated channel length
[AD-A133211] N84-15538
Variation of laser absorption with plasma scalelength in long-scalelength plasmas
[DE84-002743] N84-15991
LASER PROPULSION
Hydrogen ignition for laser propulsion N84-16026
LASER PUMPING
Laser optical pumping of sodium and lithium atom beams N84-15534
Coherently pumped two-frequency laser-type devices
[AD-A133439] N84-15545
LASER RANGE FINDERS
Rivista Tecnica Selenia, volume 8, number 2, 1982 N84-15882
Advanced techniques of laser telemetry N84-15883
LASER SPECTROSCOPY
Subpicosecond-relaxation studies using tunable-laser-induced-grating techniques N84-15531
Coherent effects in laser spectroscopy N84-15533
LASER TARGET INTERACTIONS
Development of an XUV amplifier N84-15532
LASER TARGETS
Observation of magnetic fields in laser-produced plasma using the Zeeman effect
[DE84-002742] N84-15989
LASERS
High resolution ultraviolet laser spectroscopy of mercury and helium N84-15214
Photodetachment neutralizer development. Laser-resonator study. Volume 1: Summary
[DE84-001682] N84-15547
AlGaAsSb vapor phase epitaxy and laser program
[AD-A133123] N84-15995
LATERAL CONTROL
Flying qualities experiments of rate command/attitude hold systems in the HFB 320 in-flight simulator
[DFVLR-FB-83-25] N84-15163
LATEX
Evaluation of the separability of monodisperse polystyrene latex microspheres in a continuous flow electrophoresis system N84-16057
LATTICES (MATHEMATICS)
Lattice gauge theories
[DE83-013114] N84-15906
LEAD ACID BATTERIES
Battery lifetime prediction by pattern recognition application to lead-acid battery life-cycling test data
[AD-A133281] N84-15397
LEADING EDGE SWEEP
Wind tunnel investigations of glider fuselages with different waistings and wing arrangements N84-15116
LEAR JET AIRCRAFT
Determination of elevator and rudder hinge forces on the Learjet model 55 aircraft N84-15604
LEARNING
Neuronal adaptive mechanisms underlying intelligent information processing
[AD-A133694] N84-15778
A guideline for the planning and system requirement determination of a computer based educational system
[AD-A133529] N84-15829
LEARNING THEORY
A learning approach to routing in data communication networks
[REPT-8212] N84-15834
LEAST SQUARES METHOD
Least squares and domain decomposition methods applied to the numerical solution of nonlinear problems in fluid dynamics N84-15468
Sparse Matrix Software Catalog
[AD-A133559] N84-15830
Geometric methods for linear prediction --- signal processing
[FUB-54-1982] N84-15859
Least-square iterative techniques for solving integral equations
[PB83-166751] N84-15864
LENNARD-JONES GAS
Transport algorithms for methane flames
[AD-A133213] N84-15221
LEPTONS
Cross section estimates for multi-TeV physics N84-15914

TOF for heavy stable particle identification
N84-15936

LETHALITY
Acute intramuscular toxicity (LD50) of 1,1'-trimethylenebis (4-(Hydroxyiminomethyl) pyridinium bromide) monohydrate, (TMB-4) in male mice
[AD-A133148] N84-15758
Lethal, potentially lethal lesion model
[DE84-001325] N84-15762

LEWIS NUMBERS
A review of theories currently being used to model steady plane flames on flame-holders
[CA-8316] N84-15218

LIBRARIES
Effective use of earthquake data
[AD-A134077] N84-15712
The perceptual component of relationships in library networks N84-16070
Local automation model: Functional description
[AD-A133389] N84-16077

LIBRATION
Three-dimensional, periodic halo orbits in the restricted three-body problem N84-15167

LIFT
New investigation of short wings with lateral jets
[NASA-TM-77347] N84-15124

LIFT DRAG RATIO
Optimization of waverider configurations generated from non-axisymmetric flows past a nearly circular cone
N84-15108

LIGHT SCATTERING
Application of two-dimensional discrete-ordinates methods to multiple scattering of laser radiation
[AD-A133258] N84-15539
Scattering and absorption of light by soot particles
[DE84-002306] N84-15967

LIGHT TRANSMISSION
Development of an improved protective cover/light block for multilayer insulation
[NASA-TM-82563] N84-15269

LIGHTNING
A systematic characterization of the effects of atmospheric electricity on the operational conditions of aircraft N84-15086
Airborne lightning characterization
[AD-A130627] N84-15733
Characteristics of RF lightning emission at 2 GHz and 250 MHz N84-16039

LINE OF SIGHT
ECM (Electronic Counter Measure) signal discrimination and identification techniques
[AD-A133427] N84-15372

LINE SHAPE
Subpicosecond-relaxation studies using tunable-laser-induced-grating techniques N84-15531

LINE SPECTRA
Line profile variability in winds of OB stars
N84-16085
Aperture synthesis observations of star forming regions: Compact HII regions and masers N84-16092

LINEAR ACCELERATORS
A 650 mm long liquid hydrogen target for use in a high intensity electron beam
[DE84-002552] N84-15955

LINEAR ARRAYS
Phase-only nulling at symmetric pattern locations
[AD-A133126] N84-15361

LINEAR EQUATIONS
Iterative techniques for the solution of elliptic finite difference equations N84-15435
The causation and variability of the northern winter quasi-stationary planetary waves N84-15705
Sparse Matrix Software Catalog
[AD-A133559] N84-15830
Synthesis of insensitive controllers in linear quadratic control problems
[REPT-605] N84-15841
An investigation of the use of iterative linear equation solvers in codes for large stiff systems of ODE's
[AD-A133189] N84-15845

LINEAR PREDICTION
Maximum entropy linear prediction method
[FUB-48-1982] N84-15857
Linear prediction methods — signal processing
[FUB-52-1982] N84-15858
Geometric methods for linear prediction — signal processing
[FUB-54-1982] N84-15859

LINEAR RECEIVERS
Digital communication in the presence of impulsive noise N84-15392

LINEAR SYSTEMS
Split-Stirling-cycle displacer linear-electric drive
N84-15343
Nonlinear transformat
[NASA-CR-166506] N84-15877

LINEARITY
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
Theoretical and software considerations for nonlinear dynamic analysis
[NASA-CR-174504] N84-15589
Baroclinic instability of atmospheric jets N84-15704

LINES (GEOMETRY)
Computer-Aided Structural Engineering (CASE) project. Reference manual: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133493] N84-15828

LINGUISTICS
Linguistic methodology for the analysis of aviation accidents
[NASA-CR-3741] N84-15135

LIQUEFACTION
Diode laser spectrophotometry for monitoring acetylene on-line in a liquefaction plant
[DE84-002117] N84-15548

LIQUID ALLOYS
Choice of a melting installation for aluminum alloy
[BLL-OA-TRANS-3095-(6196.3)] N84-15239

LIQUID BEARINGS
Experimental determination of gap flow-conditioned forces at turbine stages and their effect on the running stability of simple rotors
[NASA-TM-77293] N84-15553

LIQUID CHROMATOGRAPHY
Partial analysis of Insta-Foam N84-16030

LIQUID COOLING
Testing and characterizations of infrared sensor over the temperature range of 2 Kelvin to 300 Kelvin
N84-15347
A helium-3 refrigerator employing capillary confinement of liquid cryogen N84-15353
Turbulence modeling in liquid metal free convection — in reactor cooling systems N84-15490
Effectiveness of two portable liquid-cooled undergarments in reducing heat stress
[AD-A133174] N84-15801

LIQUID FILLED SHELLS
An experimental investigation of the boundary layer structures in a partially-filled horizontal and rapidly-rotating cylinder N84-15414
Liquid management in low gravity using baffled rotating containers
[NASA-TP-2263] N84-15427

LIQUID HELIUM
Propulsion apparatus and method using boil-off gas from a cryogenic liquid — controlling spacecraft attitude and drag
[NASA-CASE-MFS-25946-1] N84-15183
A helium-3 refrigerator employing capillary confinement of liquid cryogen N84-15353
Specific heat of He-3 in the Fermi liquid region
[DE83-011566] N84-16009

LIQUID HYDROGEN
A 650 mm long liquid hydrogen target for use in a high intensity electron beam
[DE84-002552] N84-15955

LIQUID METAL FAST BREEDER REACTORS
Mixed convection and stratification phenomena in liquid metals N84-15488
Single phase sodium flow in complex and deformed generators N84-15489
Turbulence modeling in liquid metal free convection — in reactor cooling systems N84-15490
Liquid metal experimental facilities — fast breeder reactors N84-15492
Studies on sodium boiling phenomena in out of pile rod bundles for various accidental situations in Liquid Metal Fast Breeder Reactors (LMFBR) experiments and interpretations N84-15493
Thermohydraulics of liquid metals, volume 2 — conferences
[VKI-LS-1983-07-VOL-2] N84-15494
Temperature distributions, boiling and dry-out behind local blockages — liquid metal fast breeder reactors (LMFBR) N84-15495
Sodium boiling experiments in bundle geometries under fast transient and steady state conditions — fast breeder reactor safety analysis N84-15496
The BLOW-3A: A theoretical model to describe transient two phase flow conditions in Liquid Metal Fast Breeder Reactor (LMFBR) coolant channels N84-15497
Theoretical simulation of thermohydraulic behavior of sodium cooled subassemblies in steady state and transient conditions — liquid metal fast breeder reactors (LMFBR) N84-15498
Computation of the thermohydraulics in subassemblies for accident situations — liquid metal fast breeder reactors (LMFBR) N84-15499
Thermohydraulics of LMFBR core catchers — liquid metal fast breeder reactors (LMFBR) N84-15500

LIQUID METALS
Embrittlement of steels due to galvanizing or coating with zinc paint: An investigation of embrittlement in welding or heating operations — liquid metal embrittlement
[AERE-TR-4774] N84-15244
Thermohydraulics of liquid metals, volume 1 — conferences
[VKI-LS-1983-07-VOL-1] N84-15487
Mixed convection and stratification phenomena in liquid metals N84-15488
Thermohydraulics in liquid metals N84-15491
Liquid metal experimental facilities — fast breeder reactors N84-15492
Thermohydraulics of liquid metals, volume 2 — conferences
[VKI-LS-1983-07-VOL-2] N84-15494
Thermohydraulic applications of liquid metals in the non-nuclear field N84-15501
Analytical and numerical solution for a solidifying liquid alloy slab N84-16025

LIQUID NITROGEN
A small and light weight heat exchanger for on-board helium refrigerator N84-15339

LIQUID OXYGEN
Atomization and mixing study
[NASA-CR-170943] N84-15428
Linear and nonlinear aspects of rotordynamics
N84-16034

LIQUID PHASE EPITAXY
Control of impurities in the epitaxial growth of high quality GaAs
[AD-A133187] N84-15996

LIQUID PROPELLANT ROCKET ENGINES
Atomization and mixing study
[NASA-CR-170943] N84-15284
Atomization and mixing study
[NASA-CR-170943] N84-15428

LIQUID ROCKET PROPELLANTS
Atomization and mixing study
[NASA-CR-170943] N84-15284

LIQUID SODIUM
Single phase sodium flow in complex and deformed generators N84-15489
Turbulence modeling in liquid metal free convection — in reactor cooling systems N84-15490
Studies on sodium boiling phenomena in out of pile rod bundles for various accidental situations in Liquid Metal Fast Breeder Reactors (LMFBR) experiments and interpretations N84-15493
Sodium boiling experiments in bundle geometries under fast transient and steady state conditions — fast breeder reactor safety analysis N84-15496
Theoretical simulation of thermohydraulic behavior of sodium cooled subassemblies in steady state and transient conditions — liquid metal fast breeder reactors (LMFBR) N84-15498
Computation of the thermohydraulics in subassemblies for accident situations — liquid metal fast breeder reactors (LMFBR) N84-15499

LIQUID-SOLID INTERFACES
Surface chemistry in the flotation of minerals
N84-15323
Spectroscopic studies on surface reactions between minerals and reagents in flotation systems N84-15324

LIQUIDS
Review of properties of various types of calorimeters: High luminosity and high energy N84-15917

LOAD DISTRIBUTION (FORCES)
Assessment of load-frequency-control impacts caused by small wind turbines
[DE82-011513] N84-15677

LOAD TESTS
Fatigue crack propagation in Al-alloy lugs under constant amplitude and maneuver spectrum loading
[TAE-497] N84-15585
Refined test methods in evaluating brittle material strengths
[AD-A133596] N84-15610

LOADS (FORCES)
Avionics concept evaluation at the force level
N84-15038
Static and dynamic stiffness reduction of graphite/epoxy composite laminates under fatigue loading N84-15194
Composite laminate weight optimization on the HX-20
[AD-A133490] N84-15207
Biaxial fatigue of graphite/epoxy + or - 45 sub s tubes N84-15210
Finite element analysis of moisture and external loading effects in composites N84-15211
Investigation of fatigue crack-growth resistance of aluminum alloys under spectrum loading
[AD-A133206] N84-15251
Crazing and fatigue behaviour of one and two phase polymers N84-15282
Orthotropic hole element N84-15595

An alternative method of analysis for base accelerated dynamic response in NASTRAN N84-15598
A NASTRAN DMAP procedure for calculation of base excitation modal participation factors N84-15599
LOFTING
FOD (Foreign Object Damage) generation by aircraft tires — probability of engine ingestion and airfield surface movements
[AD-A133319] N84-15146
LOG PERIODIC ANTENNAS
Contending with jamming in decametric waves in an adaptive system of all-directional antennas N84-15653
LOGARITHMS
A law of the iterated logarithm for non-parametric regression function estimators
[AD-A133260] N84-15847
LOGIC CIRCUITS
Video processor for air traffic control beacon system
[NASA-CASE-KSC-11155-1] N84-15395
Analyzing the roles of descriptions and actions in open systems
[AD-A133614] N84-15878
Logic simulator program N84-16023
LOGIC DESIGN
Orbital maneuvering vehicle simulation system on-board processing logic N84-16052
LOGISTICS
An approach to logistic problems by the L-transform method N84-15884
LOGISTICS MANAGEMENT
Rivista Tecnica Selenia, volume 8, number 2, 1982 N84-15882
An approach to logistic problems by the L-transform method N84-15884
LONG DURATION SPACE FLIGHT
Studies of neutron and proton nuclear activation in low-Earth orbit 2 N84-16041
LONGITUDINAL CONTROL
Flying qualities experiments of rate command/attitude hold systems in the HFB 320 in-flight simulator
[DFVLR-FB-83-25] N84-15163
LOOPS
Hardware-in-the-loop simulation techniques used in the development of the Sea Harrier avionic system N84-15071
LOSSES
The effects of dehydration on peripheral cooling
[AD-A130838] N84-15767
LOUISIANA
Analysis of data acquired by synthetic aperture radar over Dade County, Florida, and Acadia Parish, Louisiana
[E84-10067] N84-15636
LOW ALTITUDE
Some comments on the hazards associated with manoeuvring flight in severe turbulence at high speed and low altitude N84-15089
LOW ASPECT RATIO
Equilibrium studies for low-aspect-ratio torsatrons
[DE84-002264] N84-15979
LOW CARBON STEELS
Fracture resistance of hardened and tempered pipes of 16GFR steel
[BLL-M-35268-(5828.4)] N84-15584
LOW GRAVITY MANUFACTURING
Commercialization of opportunities for materials processing in low gravity
[NASA-CR-170953] N84-15165
LOW PASS FILTERS
Edge- and contour detection for correction of low-pass filtered images
[PB83-217489] N84-15969
LOW PRESSURE
Aerothermodynamics of Low Pressure Steam Turbines and Condensers, volume 1 — conferences
[VKI-LS-1983-06-VOL-1] N84-15472
The design of modern Low Pressure (LP) steam turbines N84-15473
Measurements in steam turbines N84-15476
Aerothermodynamics of Low Pressure Steam Turbines and Condensers, Volume 2 — conferences
[VKI-LS-1983-06-VOL-2] N84-15482
Wet steam flow in L. P. turbines — low pressure (LP) N84-15483
LOW SPEED
Analysis of nonplanar wing-tip mounted lifting surfaces on low-speed airplanes N84-15142
LOW TEMPERATURE
The effects of dehydration on peripheral cooling
[AD-A130838] N84-15767
LOW TEMPERATURE TESTS
1981 CRC (Coordinating Research Council) diesel fuel low-temperature operability field test
[AD-A133543] N84-15289
Utilization of low temperatures in electrical machines
[AD-A133325] N84-15399
LOW THRUST
Optimal low thrust, three burn orbit transfers with large plane changes N84-15166
LUBRICATING OILS
North Carolina used-motor-oil re-refining program: Economics and logistics and operating results
[DE84-001448] N84-15277
Inhalation toxicology. 3: Evaluation of thermal degradation products from aircraft and automobile engine oils, aircraft hydraulic fluid, and mineral oil
[AD-A133221] N84-15778
LUBRICATION
Split-Stirling, linear-resonant, cryogenic refrigerators for detector cooling N84-15342
Interactive mechanisms of sliding-surface bearings
[AD-A133127] N84-15556
LUBRICATION SYSTEMS
Interactive mechanisms of sliding-surface bearings
[AD-A133127] N84-15556
LUGS
Fatigue crack propagation in Al-alloy lugs under constant amplitude and maneuver spectrum loading
[TAE-497] N84-15585
LUMINANCE
Displaying colors of specified chrominance on a color graphics display
[AD-A133591] N84-15817
LUMINOSITY
Proceedings of the 1983 DPF Workshop on Collider Detectors: Present Capacities and Future Possibilities
[LBL-15973] N84-15911
Experience of the axial field spectrometer at the CERN ISR N84-15912
Search for Hadron jets and large transverse momentum electrons at the SPS pp collider N84-15913
Review of properties of various types of calorimeters: High luminosity and high energy N84-15917
Trigger systems which could operate at a luminosity of 10/sup 33 cm(-2) to sec/sup -1 N84-15918
Searching for limitations in capability due to high average rates N84-15919
Detectors at 20 TeV and detector considerations for a high luminosity hadron-hadron machine N84-15920
Track chambers for high luminosity N84-15921
Triggering at high luminosity: Fake triggers from pile-up N84-15932
Fast asynchronous level 1 pre-trigger for electrons at L = 10/sup 33 cm-2 sec-1 N84-15933
Use of synchrotron radiation for electron identification at high luminosity N84-15935
Operation of a high-P/sub T spectrometer arm at 10/sup 33 cm-2 sec-1 with praticle identification N84-15937
Muons and electrons in general N84-15938
Detecting heavy quark jets N84-15939
X-ray observations of cataclysmic variables N84-16084
Near infrared studies of reflection nebulae N84-16086
Optical and X-ray selected samples of quasars: Evolution of the luminosity distributions N84-16090
LUNGS
Interaction of anti-G measures and chest wall mechanics in determining gas exchange
[AD-A133740] N84-15775

M

MACH-ZEHNDER INTERFEROMETERS
High precision material study at near millimeter wavelengths
[AD-A133575] N84-15966
MACHINING
Further abbreviation of the machining schedule for producing surface-damage-free beryllium
[DOE/TIC-4500-REV-69] N84-15297
MAGNESIUM COMPOUNDS
Use of scanning electron microscopy in studying surface reactions of metals with hydrogen N84-15918
MAGNETIC ANOMALIES
Investigation of antarctic crust and upper mantle using MAGSAT and other geophysical data
[E84-10055] N84-15627
Magnetic anomalies in east Pacific using MAGSAT data
[E84-10060] N84-15630
Role of pressure in understanding the anomalous superconductivity in europium (molybdenum)6(sulfur)8 and (TMTSF)2FSO3
[DE83-017292] N84-16012
MAGNETIC COILS
Dissipation of magnetic energy during disruptive current termination — disruptions in tokamak reactors
[IPPJ-644] N84-15973
MAGNETIC COOLING
Japanese activities in refrigeration technology N84-15330
MAGNETIC DIPOLES
Magnetic-field considerations in superferric dipole
[DE84-002573] N84-15892
MAGNETIC DISPERSION
Finite geometry effects on the stability of a charged beam propagating through a relativistic annular electron beam
[AD-A133338] N84-15948
MAGNETIC FIELD CONFIGURATIONS
Elimination of stochasticity in stellarators
[DE84-001560] N84-15985
MAGNETIC FIELDS
Magnetic-field considerations in superferric dipole
[DE84-002573] N84-15892
Observation of magnetic fields in laser-produced plasma using the Zeeman effect
[DE84-002742] N84-15989
A feasibility study of electromagnetic DE-spin system for Earth orbiting satellites N84-16040
The harmonic structure of PC 3-4 magnetic pulsations at geosynchronous orbit and its relation to the solar wind N84-16106
MAGNETIC FLUX
Ambipolar diffusion in interstellar clouds: One-dimensional, isothermal collapse N84-16099
MAGNETIC MONOPOLES
Future search for grand unified theory magnetic monopoles
[DE83-009451] N84-16015
MAGNETIC PROPERTIES
Program in marine physics applied to Navy undersea missions
[AD-A133119] N84-15753
MAGNETIC SURVEYS
Synthesis of regional crust and upper-mantle structure from seismic and gravity data
[E84-10061] N84-15631
MAGNETIC TAPES
FGGE/SBUV tape specification and shipping letter description
[NASA-CR-170482] N84-16071
FGGE/ERBM tape specification and shipping letter description
[NASA-CR-170547] N84-16072
FGGE/ERBZ tape specification and shipping letter description
[NASA-CR-170548] N84-16073
MAGNETIZATION
Superconducting ground state of a strongly interacting electron system: UBe13
[DE84-001706] N84-16003
MAGNETOHYDRODYNAMIC FLOW
Thermal and electrical interaction of tantalum with a low temperature chemically active plasma flow
[NASA-TM-77374] N84-15980
MAGNETOHYDRODYNAMIC STABILITY
Microinstabilities in the high latitude F region: A brief review
[DE84-001709] N84-15719
Plasma wave experiment for the ISEE-3 mission
[NASA-CR-175132] N84-15972
Equilibrium studies for low-aspect-ratio torsatrons
[DE84-002264] N84-15979
Computations of the current profile influence on tearing instability
[NASA-TM-77285] N84-15981
Radial structure of curvature-driven instabilities in hot-electron plasma
[DE84-002256] N84-15986
Drift waves in rotating plasmas
[DE84-000391] N84-15988
MAGNETOHYDRODYNAMIC WAVES
X-ray observations of cataclysmic variables N84-16084
MAGNETOSPHERE
Non-stochastic acceleration of protons in the magnetic neutral sheet
[IPPJ-646] N84-15975
MAGNUS EFFECT
Computations of projectile magnus effect at transonic velocities
[AD-A133212] N84-15127
MAINTAINABILITY
Design, development and flight test of a demonstration advanced avionics system N84-15067
A performance-based technique for assessing equipment maintainability
[AD-A133518] N84-15809
MAINTENANCE
A future system design technique based on functional decomposition, supported by quantifiable design aims, and guidelines for minimum maintenance costs N84-15039

Microwave methods and apparatus for paving and paving maintenance
[DE84-016306] N84-15359
A performance-based technique for assessing equipment maintainability
[AD-A133618] N84-15809
An approach to logistic problems by the L-transform method N84-15884

MAN MACHINE SYSTEMS
System architecture: Key to future avionics capabilities N84-15035
Flight Mechanics and System Design Lessons From Operational Experience
[AGARD-CP-347] N84-15076
The analysis of records of parameters: An indispensable tool in oversight and in operations control N84-15082
The man-machine interface in new generation commercial aircraft N84-15096
New flight deck design in the light of the operational capabilities N84-15097
Automatic inspection for printed wiring
[AD-A133328] N84-15586
Applied psychology in Europe: An ONR perspective
[AD-A133093] N84-15797

MANAGEMENT ANALYSIS
Perspectives on oversight management of software development projects
[AD-A133404] N84-16064
Organizational-climate dimensions: A conceptual and judgmental analysis
[AD-A132698] N84-16068

MANAGEMENT METHODS
Appraisal of scientific resources for emergency management
[AD-A133285] N84-16062

MANAGEMENT PLANNING
Commercialization of opportunities for materials processing in low gravity
[NASA-CR-170953] N84-15165
Perspectives on oversight management of software development projects
[AD-A133404] N84-16064

MANAGEMENT SYSTEMS
Navy's advanced aircraft armament system program concept objectives N84-15045

MANIPULATORS
Robotics-related technology in the nuclear industry
[DE83-017131] N84-15799
Robot manipulator control
[AD-A129365] N84-15800
Computer control of a seven degree of freedom manipulator arm N84-16051

MANNED SPACE FLIGHT
An alternate concept for expanding man's presence in space
[NASA-TM-84617] N84-15172

MANUFACTURING
ISIS: A constraint-directed reasoning approach to job shop scheduling
[AD-A133296] N84-16063

MAPPING
Analysis of data acquired by synthetic aperture radar over Dade County, Florida, and Acadia Parish, Louisiana
[E84-10067] N84-15636
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data
[E84-10068] N84-15637
The future in terrain elevation data processing at the Defense Mapping Agency
[AD-A133483] N84-15641
Image understanding research and its application to cartography and computer-based analysis of aerial imagery
[AD-A133495] N84-15642
Use of LANDSAT MSS (multispectral scanner) digital data in water quality mapping of the Neuse River estuary, North Carolina
[PB83-256750] N84-15645
Propagation effects in satellite-borne synthetic aperture radars N84-15650
Characteristics of RF lightning emission at 2 GHz and 250 MHz N84-16039

MAPS
Evaluation of map symbols for a computer generated topographic display: Transfer of training, symbol confusion, and association value studies
[AD-A133590] N84-15643
A comparison of map learning methods: Map study, simulated travel and mixed
[AD-A133544] N84-15794
The circularly polarized sun at 12.6 cm wavelength
[AD-A133668] N84-16110

MARINE BIOLOGY
The role of microorganisms in marine corrosion processes
[AD-A133113] N84-15757
A preliminary survey of plankton and periphyton in the Turn Barge Canal and basin area of Kennedy Space Center, Florida N84-16027

MARINE ENVIRONMENTS
Satellite measurements of marine aerosols N84-15671
Marine environmental acoustics
[AD-A133245] N84-15902

MARINE METEOROLOGY
An analysis of aircraft data collected in the Alboran Sea during Donde Va?, 6 - 18 October 1982
[AD-A133995] N84-15746

MARINE TECHNOLOGY
Rubber-modified epoxy and glass laminates for application to naval ship structures
[AD-A133305] N84-15204

MARKOV PROCESSES
Advanced teleprocessing systems
[AD-A133555] N84-15378
Application of the Gibbs distribution to image segmentation
[AD-A133406] N84-15850
Methods of the analysis of the disruption of tracking
[AD-A133335] N84-15963

MASERS
Maser cavity servo-tuning system
[NASA-CASE-NPO-15690-1] N84-15536
Aperture synthesis observations of star forming regions: Compact H2 regions and masers N84-16092

MASS FLOW
A report on superfluid helium flow through porous plugs for space science applications N84-16043

MASS RATIOS
Three-dimensional, periodic halo orbits in the restricted three-body problem N84-15167

MASS SPECTRA
Increased confidence in spectrum matching by use of a retention time library --- compound identification in industrial effluents
[PB83-232090] N84-15229

MASS SPECTROMETERS
Laboratory automation of a quadrupole mass spectrometer N84-16053

MASS SPECTROSCOPY
Polymer characterization by electrohydrodynamic ionization mass spectrometry: Probing composition and chemistry of mixtures in solution N84-15264
Secondary ion emission from adsorbate layers on polycrystalline Ni N84-15306
Experimental studies of secondary ion emission from well-characterized surfaces
[AD-A133186] N84-15943

MATCHED FILTERS
Adaptive signal detection for the optimal communications receiver
[AD-A133498] N84-15374

MATERIALS HANDLING
Laboratory robotics at the Savannah River Laboratory
[DE84-001760] N84-15810

MATHEMATICAL MODELS
A model of the trailing edge separation on an airfoil
[AD-A126703] N84-15125
A formula for the sputtering yield of polycrystalline materials N84-15313
Flat cloud modeling --- unconfined gas explosions N84-15442
Estimate of blast wave properties --- unconfined vapor cloud explosions (UVCE) N84-15443
Computation of turbulent gas-particle suspension flows in channels N84-15470
Improved turbulence models based on large eddy simulation of homogeneous, incompressible turbulent flows N84-15514
Application of two-dimensional discrete-ordinates methods to multiple scattering of laser radiation
[AD-A133258] N84-15539
Heat generation in aircraft tires under braked rolling conditions
[NASA-CR-3768] N84-15587
Multiple paths on the ocean surface N84-15666
The salt-gradient solar pond
[AD-A126702] N84-15683
Development of theoretical models and analyses of the micro-physics of cloud and precipitation systems
[AD-A133557] N84-15735
Report and recommendations for improving constitutive relations used in computer codes --- shock mechanics in solids
[AD-A133239] N84-15823
Experimental designs for quantal response models
[AD-A133416] N84-15851
Spinning mode acoustic radiation from the flight inlet
[NASA-CR-172273] N84-15896
Production networks: A dynamic model of production
[AD-A133571] N84-16065

MATRICES (MATHEMATICS)
Application of the density matrix multipole expansion to stark quantum beats from beam-foil-excited hydrogen atoms
[AD-A133603] N84-15193
NASA/MSFC NASTRAN auxiliary I/O routines N84-15592
Acoustical modes of arbitrary volumes using NASTRAN transient heat transfer RF9 N84-15597
Sparse Matrix Software Catalog
[AD-A133559] N84-15830
The generalized Euler-Mascheroni constants N84-16024
Population control of self-replicating systems: Option C N84-16044

MATRIX METHODS
Study on damping representation related to spacecraft structural design
[EMSB-18/83] N84-15182

MAXIMUM ENTROPY METHOD
Maximum entropy linear prediction method
[FUB-48-1982] N84-15857
Rivista Tecnica Selenia, volume 8, number 3, 1983 N84-15887
The maximum entropy method and its application to clutter cancellation N84-15890

MAXIMUM LIKELIHOOD ESTIMATES
On the maximum likelihood estimate for logistic errors-in-variables regression models
[AD-A133253] N84-15868

MAXWELL EQUATION
Fourier optics for the Maxwell field: Formalism and applications
[DE84-002845] N84-15383

MEASURE AND INTEGRATION
Critical factors and operational research in tactical fighter avionic system development N84-15062

MEASURING INSTRUMENTS
The measurement of surface texture and its correlation with function N84-15299

MECHANICAL DEVICES
Mechanical fastener
[NASA-CASE-LAR-12738-2] N84-15180

MECHANICAL DRIVES
Compact Claude cycle refrigerator for laboratory use N84-15338
Life test performance of a Philips rhombic-drive refrigerator with bellows seals N84-15341

MECHANICAL PROPERTIES
Metals and ceramics research: Processing, properties, and applications
[ORNL-5943] N84-15187
Production and characterization of beta-silicon carbide and alpha-silicon nitride whiskers for ceramic matrix composites
[LA-9650-MS] N84-15197
Powder metallurgy
[BLL-M-35271-(5828.4)] N84-15231
Stability of mechanical properties of cold-drawn rolled metal with high-temperature thermomechanical treatment
[BLL-M-35292-(5828.4)] N84-15233
Diffusion films produced by heat treatment of electroplated coatings
[BLL-OA-TRANS-3082-(6196.3)] N84-15237
The influence of the environment on the mechanical characteristics of composite materials: Design considerations --- polymer matrix composites
[INTA-INFORME-I-1/221/720/83047] N84-15281
Crazing and fatigue behaviour of one and two phase polymers N84-15282
Utilization of low temperatures in electrical machines
[AD-A133325] N84-15399
Mechanical property characterization of F-100/934 graphite-epoxy composite material N84-16031

MEDIA
Reflection and transmission of electromagnetic waves at a rough interface between two different media
[PB83-217588] N84-15389
The parabolic approximation for sound propagation in stratified moving media N84-15893

MEDICAL EQUIPMENT
Low X-ray absorption aneurism clips
[NASA-CASE-LAR-12650-2] N84-15764

MEDICAL SERVICES
Medical aspects of survival: Training for aircrew
[AGARD-AG-283(FR)] N84-15787

MEDITERRANEAN SEA
Expendable bathythermograph (XBT) measurements in the Western Alboran Sea, October 1982
[AD-A133939] N84-15748

The advection of submesoscale thermal features in the Alboran Sea Gyre
[AD-A133877] N84-15749

MELTING
Choice of a melting installation for aluminum alloy
[BLL-OA-TRANS-3095-(6196.3)] N84-15239
Hot melt recharge system --- space maintenance
[NASA-CASE-LAR-12881-2] N84-15271

MELTING POINTS
On the functional dependence of the freezing point of soils on the composition of water soluble salts in an interstitial solution
[NRC/CNR-TT-2070] N84-15707

MELTS (CRYSTAL GROWTH)
A melt for the electrolytic application of titanium plating
[BLL-OA-TRANS-3111-(6L96.3)] N84-15241

MEMBRANES
Luminescence probe studies of nafion polyelectrolytes
[AD-A133519] N84-15224

MEMORY
Duration of memory loss due to electron beam exposure
[AD-A132941] N84-15760
A comparison of map learning methods: Map study, simulated travel and mixed
[AD-A133544] N84-15794

MENTAL PERFORMANCE
Neuronal adaptive mechanisms underlying intelligent information processing
[AD-A133694] N84-15776
A study on airborne integrated display system and human information processing
[NASA-TM-77338] N84-15789
A comparison of map learning methods: Map study, simulated travel and mixed
[AD-A133544] N84-15794

MERCURY (METAL)
High resolution ultraviolet laser spectroscopy of mercury and helium N84-15214

MERCURY CADMIUM TELLURIDES
Study of phase diagrams of ternary semiconductors
[AD-A133556] N84-16000
Compositional segregation in unidirectionally solidified solid solution crystals N84-16055

MERCURY COMPOUNDS
Development of a mercuric iodide solid state spectrometer for X-ray astronomy
[NASA-CR-175330] N84-16096

MERIDIONAL FLOW
Turbine aerodynamic design using through-flow theory. Meridional through-flow calculation N84-15474
Applications of through-flow theory --- steam turbines N84-15477
Wet steam flow in L. P. turbines --- low pressure (LP) N84-15483

MEROMORPHIC FUNCTIONS
The generalized Euler-Mascheroni constants
[NASA-TP-2264] N84-15880

MESH
Practical three-dimensional mesh generation using transfinite interpolation N84-15483
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602

MESOSCALE PHENOMENA
Utilization of satellite data in mesoscale models of severe weather
[NASA-CR-175122] N84-15730
Analysis of severe storm data
[NASA-CR-170947] N84-15732
Investigation of the arc cloud complex N84-16029

MESSAGE PROCESSING
Analyzing the roles of descriptions and actions in open systems
[AD-A133614] N84-15878

METAL CRYSTALS
Structural properties of epitaxial single layer metals on (110) B.C.C. metal substrates N84-15326

METAL FATIGUE
Elevated temperature low cycle fatigue of nickel base superalloys in the conventionally cast, directionally solidified and single crystal forms
[AD-A133598] N84-15253
Fatigue crack propagation in Al-alloy lugs under constant amplitude and maneuver spectrum loading
[TAE-497] N84-15585

METAL FINISHING
Further abbreviation of the machining schedule for producing surface-damage-free beryllium
[DOE/TIC-4500-REV-69] N84-15297

METAL IONS
Precipitation of metals from solutions by baser metals
[CSIR-1712] N84-15242

METAL MATRIX COMPOSITES
Fracture behavior of unidirectional boron/aluminum composite laminates
[NASA-CR-3753] N84-15196
Arc spray fabrication of metal matrix composite monotape --- high temperature fiber-reinforced superalloy composites
[NASA-CASE-LEW-13828-1] N84-15203

METAL OXIDE SEMICONDUCTORS
Evaluation of radiation damage to Metal-Oxide-Semiconductor (MOS) devices
[AD-A133593] N84-16002
Logic simulator program N84-16023

METAL POWDER
Powder metallurgy
[BLL-M-35271-(5828.4)] N84-15231

METAL SPRAYING
Arc spray fabrication of metal matrix composite monotape --- high temperature fiber-reinforced superalloy composites
[NASA-CASE-LEW-13828-1] N84-15203

METAL SURFACES
Further abbreviation of the machining schedule for producing surface-damage-free beryllium
[DOE/TIC-4500-REV-69] N84-15297
The use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition N84-15307
A formula for the sputtering yield of polycrystalline materials N84-15313
The descaling of 3Cr12 steel N84-15322

METAL VAPOR LASERS
Copper vapor laser scale demonstration
[AD-A133327] N84-15543

METAL WORKING
Stability of mechanical properties of cold-drawn rolled metal with high-temperature thermomechanical treatment
[BLL-M-35292-(5828.4)] N84-15233

METALLIC GLASSES
EXAFS studies of the metallic glass La80Ga20
[DE84-002022] N84-15278

METALS
Metals and ceramics research: Processing, properties, and applications
[ORNL-5943] N84-15187
Design and use of nonstandard tensile specimens for irradiated materials testing
[DE84-001468] N84-15254
A thermodynamically consistent constitutive model for inelastic flow of materials N84-15581

METEOROLOGICAL BALLOONS
Aerostat icing problems
[AD-A133403] N84-15272

METEOROLOGICAL PARAMETERS
Range reference atmosphere 0-30 km altitude, Eglin AFB, Florida
[AD-A133506] N84-15734
Taquac, Guam Island. Range reference atmosphere 0-30 km altitude
[AD-A133618] N84-15736

METEOROLOGICAL SATELLITES
Utilization of satellite data in mesoscale models of severe weather
[NASA-CR-175122] N84-15730
Analysis of severe storm data
[NASA-CR-170947] N84-15732

METEOSAT SATELLITE
The European Space Agency's Earth observation satellite programmes N84-15647

METHANE
Procedure for producing higher hydrocarbons
[NRC/CNR-TT-2073] N84-15217
Transport algorithms for methane flames
[AD-A133213] N84-15221

MICE
Acute intramuscular toxicity (LD50) of 1,1'-trimethylenebis (4-(Hydroxyiminomethyl) pyridinium bromide) monohydrate, (TMB-4) in male mice
[AD-A133148] N84-15758

MICHELSON INTERFEROMETERS
Far Infrared Radiometric Spectrometer (FIRRS)
[AD-A133552] N84-15527

MICROCHANNEL PLATES
Nanosecond image-shuttering studies at Los Alamos National Laboratory
[DE84-001733] N84-15405

MICROCOMPUTERS
Laboratory automation of a quadrupole mass spectrometer N84-16053

MICROELECTRONICS
Calculation of cosmic ray induced single event upsets: Program CRUP (Cosmic Ray Upset Program)
[AD-A133620] N84-16113

MICROFILMS
Computer-Output Microfiche (COM) on the Oak Ridge computer network
[DE84-002422] N84-15836

MICROMINIATURIZED ELECTRONIC DEVICES
Low cost microminiature refrigerators for large unit volume applications N84-15356

MICROORGANISMS
The role of microorganisms in marine corrosion processes
[AD-A133113] N84-15757
Rapid identification of micro-organisms
[AD-A132831] N84-15759

MICROPARTICLES
Evaluation of the separability of monodisperse polystyrene latex microspheres in a continuous flow electrophoresis system N84-16057

MICROPROCESSORS
The use of microprocessors for the instrumentation of nondestructive tests
[CISE-2072] N84-15571
Implementation of automatic focusing algorithms for a computer vision system with camera control
[AD-A133492] N84-15807
A modular twin bus microprocessor system for laboratory automation
[AD-A133372] N84-15815
Design and microprocessor-based implementation of digital frequency selective filters for application in terrain roughness identification
[AD-A133459] N84-15826

MICROPROGRAMMING
The debugging of real time multiprocessor systems: An integrated solution proposal
[CISE-2067] N84-15837

MICROSCOPY
Project objectives and progress at the Research Laboratory of Electronics
[RLE-125] N84-16016

MICROSTRUCTURE
Calculation of structure factor for different cluster models of an amorphous alloy
[BLL-M-35293-(5828.4)] N84-15234
Diffusion films produced by heat treatment of electroplated coatings
[BLL-OA-TRANS-3082-(6196.3)] N84-15237
Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy
[DE84-001985] N84-15257
Pit initiation resistance of ferritic stainless steels in chloride environments from 800 to 2600C
[DE84-000355] N84-15258
A thermodynamically consistent constitutive model for inelastic flow of materials N84-15581
Fabrication and properties of multilayer structures
[NASA-CR-174506] N84-15997
Superconducting properties of Nb3Sn multifilamentary wires fabricated by internal tin process
[DE83-018189] N84-16011

MICROWAVE ANTENNAS
The small transmitter receiver stations in the Sirio experiment --- microwave transmission
[FUB-50-1982] N84-15386

MICROWAVE ATTENUATION
Statistic prediction techniques of rain attenuation starting from pluviometric statistics --- microwave attenuation
[FUB-51-1982] N84-15387

MICROWAVE CIRCUITS
Organometallic epitaxy for GaAs/AlGaAs microwave transistors and integrated circuits
[AD-A133569] N84-16001

MICROWAVE EQUIPMENT
Microwave methods and apparatus for paving and paving maintenance
[DE84-016306] N84-15359

MICROWAVE HOLOGRAPHY
Recording and reproduction of microwave holograms using a scanning procedure and their subsequent optical processing
[NASA-TM-77349] N84-15519

MICROWAVE IMAGERY
Snow thickness and brightness temperature on multi-year ice
[AD-A133940] N84-15747

MICROWAVE RADIOMETERS
Support for the Naval Research Laboratory Environmental Passive Microwave Remote Sensing Program
[AD-A133330] N84-15526

MICROWAVE SPECTRA
Development of visible/infrared/microwave agriculture classification and biomass estimation algorithms, volume 2 --- Oklahoma and Texas
[E84-10059] N84-15629

MICROWAVE TRANSMISSION
The small transmitter receiver stations in the Sirio experiment --- microwave transmission
[FUB-50-1982] N84-15396
MICROWAVE TUBES
Microwave tubes: Literature survey number 4, comprising the year 1982
[FOA-C-30331-E] N84-15407
MICROWAVES
Design considerations for remotely piloted, high-altitude airplanes powered by microwave energy
[NASA-TM-85730] N84-15145
The nature of microwave backscattering from water waves N84-15665
Effects of long-term low-level radiofrequency radiation exposure on rats. Volume 1: Design, facilities, and procedures
[AD-A134079] N84-15756
MIDLATITUDE ATMOSPHERE
Middle latitude forcing of a model tropical atmosphere with horizontally nonuniform basic states N84-15724
MIE SCATTERING
Mie code AGAUS 82
[AD-A133489] N84-15964
MILITARY AIRCRAFT
Crew station evaluation in a dynamic flight simulation facility N84-15069
Analysis of US Coast Guard HU-25A visual and radar detection performance
[AD-A133380] N84-15138
MILITARY OPERATIONS
Computer aided construction of ground attack mission profiles over European terrain N84-15060
A dynamic approach to military avionics systems testing N84-15075
Analysis of US Coast Guard HU-25A visual and radar detection performance
[AD-A133380] N84-15138
Broadband base isolated asymmetrically fed VHF antenna N84-15393
MILITARY TECHNOLOGY
Image understanding research and its application to cartography and computer-based analysis of aerial imagery
[AD-A133495] N84-15642
MILLIMETER WAVES
Millimeter wave guiding structures and antennas
[AD-A133528] N84-15376
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1
[AD-A133587] N84-15380
High precision material study at near millimeter wavelengths
[AD-A133575] N84-15966
MINERAL OILS
Inhalation toxicology. 3: Evaluation of thermal degradation products from aircraft and automobile engine oils, aircraft hydraulic fluid, and mineral oil
[AD-A133221] N84-15778
MINERALS
Surface chemistry in the flotation of minerals N84-15323
Spectroscopic studies on surface reactions between minerals and reagents in flotation systems N84-15324
Optical properties of natural minerals and other materials in the 350-50000 cM-1 spectral region
[AD-A133530] N84-15965
MINIMAX TECHNIQUE
A minimax theorem for antijamming group codes
[DFVLR-FB-83-30] N84-15879
MIRAGE AIRCRAFT
Methods for developing the navigation and weapon systems of the Mirage 2000 N84-15068
The MIRAGE 2000: Fly by wire control and safety N84-15093
MIRRORS
Photodetachment neutralizer development. Laser-resonator study. Volume 1: Summary
[DE84-001682] N84-15547
MISSILE ANTENNAS
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371
MISSILE COMPONENTS
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371
MISSILES
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169
MISSION PLANNING
Advanced automation program. Program master plan
[DOT/FAA/AP-83/3] N84-15139
Payload missions integration
[NASA-CR-170949] N84-15171
An alternate concept for expanding man's presence in space
[NASA-TM-84617] N84-15172
MISSIONS
Computer aided construction of ground attack mission profiles over European terrain N84-15060
MISSISSIPPI
Prototype tidal data analysis for Mississippi Sound and adjacent areas
[AD-A134071] N84-15744
MIXING
Atomization and mixing study
[NASA-CR-170943] N84-15428
MIXING CIRCUITS
The effects of acoustic excitation on the mixing of two parallel laminar streams of fluid
[AD-A126788] N84-15502
MIXTURES
Sputtering of multicomponent materials N84-15312
Process for isotope separation
[DE84-001983] N84-15507
MOBILE COMMUNICATION SYSTEMS
Advanced teleprocessing systems
[AD-A133554] N84-15377
MOBILITY
The Stanford cart and the CMU Rover
[NASA-CR-174502] N84-15803
MODAL RESPONSE
Multishaker modal testing
[NASA-CR-170952] N84-15521
Digital multishaker modal testing
[NASA-CR-170951] N84-15522
A NASTRAN DMAP procedure for calculation of base excitation modal participation factors N84-15599
MODULES
Critical factors and operational research in tactical fighter avionic system development N84-15062
MODULUS OF ELASTICITY
Stiffness changes in unidirectional composites caused by crack systems
[CA-8311] N84-15198
MOISTURE
Finite element analysis of moisture and external loading effects in composites N84-15211
A diagnostic case study of the effects of deep extratropical convection on the large-scale temperature and moisture structure N84-15695
MOISTURE CONTENT
The influence of the environment on the mechanical characteristics of composite materials: Design considerations --- polymer matrix composites
[INTA-INFORME-I-1/221/720/83047] N84-15281
Aerodynamics and steam wetness fraction of a multistage turbine. Comparison of prediction with experimental data N84-15475
MOLECULAR BIOLOGY
New polymers for low-gravity purification of cells by phase partitioning
[NASA-CR-170957] N84-15267
MOLECULAR CLOUDS
The interstellar medium along the line of sight toward X Per N84-16101
MOLECULAR DIFFUSION
Volume recovery in glasses: A free-volume diffusion process
[DE83-013771] N84-15280
MOLECULAR FLOW
Numerical solution to the steady state equation of transfer in azimuthally symmetric geometries --- heat transfer and molecular flow
[DE84-001781] N84-15509
MOLECULAR OSCILLATIONS
Average vibrational energy transfer during a single collision of excited molecules with heat bath molecules
[AD-A133391] N84-15949
Interactions of vibrationally excited molecules with solid surfaces
[AD-A133449] N84-15950
MOLECULAR SPECTRA
Optical diagnostics for condensed-phase shock-compressed molecular systems
[DE84-001172] N84-15510
MOLECULAR WEIGHT
Relationship between the glass transition temperature and the chemical structure of polymers
[RAE-LIB-TRANS-2098] N84-15265
Ultrahigh molecular weight aromatic siloxane polymers N84-16042
MOLECULES
Heat capacity and thermodynamic properties of linear macromolecules N84-15263
MOLTEN SALTS
Polymer coated electrodes in ambient temperature molten salts
[AD-A133202] N84-15220
A melt for the electrolytic application of titanium plating
[BLL-OA-TRANS-3111-(6L96.3)] N84-15241
MOLYBDENUM ALLOYS
Grain boundary segregation and cavity formation in creep embrittled Cr-Mo steels N84-15320
MOLYBDENUM COMPOUNDS
Theoretical and experimental studies of the electronic structure of the Mo3(Micro3-0)(Micro3-OR)(Micro-OR)3(OR)6 type of triangulo metal atom cluster compound
[AD-A133516] N84-15951
MOLYBDENUM SULFIDES
Role of pressure in understanding the anomalous superconductivity in europium (molybdenum)6(sulfur)8 and (TMTSF)2FSO3
[DE83-017292] N84-16012
MOMENTS
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
MOMENTUM TRANSFER
Combustion at the interface of an oxidizer-fuel slab system N84-15215
MONITORS
ECM (Electronic Counter Measure) signal discrimination and identification techniques
[AD-A133427] N84-15372
MONOMOLECULAR FILMS
Immobilization of biomolecules on semiconductor surfaces
[FOA-C-40178-C2(B2,A3)] N84-15408
MONTE CARLO METHOD
Lattice gauge theories
[DE83-013114] N84-15906
Detecting heavy quark jets N84-15939
MOORING
The long term upper ocean study (LOTUS). Cruise summary and hydrographic data report, ENDEAVOR 97, April 1983
[AD-A134005] N84-15745
MOSSBAUER EFFECT
Moessbauer spectroscopy study of amorphous Fe87B11Au2 ribbon and its crystallization products
[DE83-018091] N84-16010
MOTION PERCEPTION
Optical flow and texture variables useful in simulating self motion (2)
[AD-A133597] N84-15779
MOTIVATION
The design of effective reward systems
[AD-A132859] N84-16067
MOUNTAINS
Spatial reasoning to determine stream network from LANDSAT imagery
[E84-10063] N84-15632
MRCA AIRCRAFT
Concepts for avionic and weapon integration facilities N84-15070
MULTILAYER INSULATION
Development of an improved protective cover/light block for multilayer insulation
[NASA-TM-82563] N84-15269
Heat transfer retardation at elevated temperatures. Phase 1: Analysis of heat transfer retardation configurations and materials
[AD-A133509] N84-16017
MULTIPLE ACCESS
Advanced teleprocessing systems
[AD-A133525] N84-15375
Advanced teleprocessing systems
[AD-A133554] N84-15377
MULTIPLEXING
Engineering evaluations and studies. Volume 3: Exhibit C
[NASA-CR-171727] N84-15177
MULTIPROCESSING (COMPUTERS)
The debugging of real time multiprocessor systems: An integrated solution proposal
[CISE-2067] N84-15837
MULTIPROGRAMMING
Simulation requirements to support the development of a fault tolerant avionic system N84-15072
Software testing of safety critical systems N84-15073
The debugging of real time multiprocessor systems: An integrated solution proposal
[CISE-2067] N84-15837

MULTISPECTRAL BAND CAMERAS
Study of the onboard calibration equipment of the HRV camera --- SPOT satellite
[ESA-TT-794] N84-15529

MULTISPECTRAL BAND SCANNERS
In-flight absolute radiometric calibration of the thematic mapper
[E84-10064] N84-15633
Spectral characterization of the LANDSAT thematic mapper sensors
[E84-10065] N84-15634
A correlation analysis of percent canopy closure versus TMS spectral response for selected forest sites in the San Juan National Forest, Colorado
[E84-10066] N84-15635
Use of LANDSAT MSS (multispectral scanner) digital data in water quality mapping of the Neuse River estuary, North Carolina
[PB83-256750] N84-15645

MULTISTATIC RADAR
Rivista Tecnica Selenia, volume 8, number 2, 1982 N84-15882
Optimum and sub-optimum processors for multistatic radar systems N84-15885

MUONS
Muons and electrons in general N84-15938

MUSCLES
Development and assessment of the Monark cycle ergometer for anaerobic muscular exercise
[AD-A133173] N84-15523
Acute intramuscular toxicity (LD50) of 1,1'-trimethylenebis (4-(Hydroxyiminomethyl) pyridinium bromide) monohydrate, (TMB-4) in male mice
[AD-A133148] N84-15758
Differentiated ratings of perceived exertion and selected physiological responses during prolonged upper and lower body exercise
[AD-A134086] N84-15769
Interaction of anti-G measures and chest wall mechanics in determining gas exchange
[AD-A133740] N84-15775

MUSCULAR FATIGUE
Experiments on factors that influence muscular function in man
[AD-A133928] N84-15771

MUSCULAR FUNCTION
Experiments on factors that influence muscular function in man
[AD-A133928] N84-15771

MUSCULOSKELETAL SYSTEM
Stress fractures: The remodelling response to excessive repetitive loading
[AD-A130881] N84-15765

N

NACELLES
Connecting aircraft and external loads N84-15046

NASA PROGRAMS
Detroit space odessey
[NASA-TM-85487] N84-15164
Cleveland Space Odyssey
[NASA-TM-85493] N84-16020
Research reports: 1983 NASA/ASEE Summer Faculty Fellowship Program
[NASA-CR-170942] N84-16022
Chronology of KSC and KSC related events for 1981
[NASA-TM-85510] N84-16060
A guide to research in NASA history, 7th edition
[NASA-TM-85486] N84-16076

NASTRAN
NASTRAN documentation for flutter analysis of advanced turbopropellers
[NASA-CR-167927] N84-15153
Dynamic certification of a thrust-measuring system for large solid rocket motors N84-15603
Determination of elevator and rudder hinge forces on the Learjet model 55 aircraft N84-15604
A new method for generating and maintaining rigid formats in NASTRAN N84-15605
Implementation of elastic-plastic structural analysis into NASTRAN N84-15606
Elastic-plastic analysis of annular plate problems using NASTRAN N84-15607
Bolt in bore boundaries N84-15608

NATIONAL PARKS
A correlation analysis of percent canopy closure versus TMS spectral response for selected forest sites in the San Juan National Forest, Colorado
[E84-10066] N84-15635

NAVIER-STOKES EQUATION
Computations of projectile magnus effect at transonic velocities
[AD-A133212] N84-15127
Finite-difference approximations of the Navier-Stokes equations for incompressible flows N84-15434
Higher order approximations in fluid mechanisms: Compact to spectral N84-15466

NAVIGATION AIDS
Integration of ICNIA into advanced high performance fighter aircraft N84-15059
Multispectral Data Processing System (MDPS)
[AD-A133426] N84-15816

NEAR INFRARED RADIATION
Near infrared studies of reflection nebulae N84-16086

NEBULAE
Near infrared studies of reflection nebulae N84-16086
Observations of the unidentified 3.3 microns emission feature in compact HII regions N84-16089

NEGATIVE IONS
Extraction of volume produced H(-) or D(-) ions from a sheet plasma I
[IPPJ-645] N84-15974

NEODYMIUM LASERS
Observation of magnetic fields in laser-produced plasma using the Zeeman effect
[DE84-002742] N84-15989
Variation of laser absorption with plasma scalelength in long-scalelength plasmas
[DE84-002743] N84-15991

NETWORK ANALYSIS
A learning approach to routing in data communication networks
[REPT-8212] N84-15834
Logic simulator program N84-16023
Production networks: A dynamic model of production
[AD-A133571] N84-16065

NETWORK CONTROL
Efficient utilization of the DRAMA service channel
[AD-A133286] N84-15368

NETWORK SYNTHESIS
Aperture efficiency considerations in the convolution synthesis of symmetrical hexagonal arrays
[AD-A133367] N84-15369

NETWORKS
Network communications for a distributed avionics system N84-15052

NEUTRAL SHEETS
Non-stochastic acceleration of protons in the magnetic neutral sheet
[IPPJ-646] N84-15975

NEUTRON ACTIVATION ANALYSIS
Studies of neutron and proton nuclear activation in low-Earth orbit 2 N84-16041

NEUTRON SOURCES
Design and use of nonstandard tensile specimens for irradiated materials testing
[DE84-001468] N84-15254

NEUTRON STARS
Theoretical calculation of rapid X-ray transients and radius expansion
[DE84-001312] N84-16114

NICKEL
Interactions of vibrationally excited molecules with solid surfaces
[AD-A133449] N84-15950

NICKEL ALLOYS
Influence of alloying on the properties of nickel in the solid and liquid states
[BLL-M-35284-(5828.4)] N84-15232
Low-cost single-crystal turbine blades, volume 1
[NASA-CR-168218] N84-15247
Elevated temperature low cycle fatigue of nickel base superalloys in the conventionally cast, directionally solidified and single crystal forms
[AD-A133598] N84-15253

NICKEL COMPOUNDS
Secondary ion emission from adsorbate layers on polycrystalline Ni N84-15306

NICKEL STEELS
The nature of quasicleavage fracture in tempered 5.5 ni steel after hydrogen charging
[AD-A133460] N84-15252

NITRAMINE PROPELLANTS
Catalysis of nitramine propellants by mmtal borohydrides
[AD-A133215] N84-15285

NITROGEN
Observations on the vanadium-nitrogen system and on pure metallic vanadium
[CSIR-TRANS-1708] N84-15243
Vacuum ultraviolet photofragmentation of H2O and NO2: Laboratory studies and atmospheric applications N84-15703

NOBLE METALS
Precipitation of metals from solutions by baser metals
[CSIR-1712] N84-15242

NOISE GENERATORS
Transonic noise generation by duct and profile flow
[AD-A129367] N84-15899

NOISE MEASUREMENT
Aeroacoustics: Ten Years of Research --- conferences
[VKI-LS-1983-05] N84-15025
Instrumentation and signal analysis --- aeroacoustics N84-15032
Study of noise-certification standards for aircraft engines. Volume 2: Procedures for measuring far field sound pressure levels around an outdoor jet-engine test stand
[AD-A133408] N84-15158

NOISE POLLUTION
Airport noise control strategies
[AD-A133137] N84-15900

NOISE PROPAGATION
Study of noise-certification standards for aircraft engines. Volume 1: Noise-control technology for turbofan engines
[AD-A133386] N84-15157
Extraterrestrial radio noise and its effect on radar performance N84-15662

NOISE REDUCTION
Mach 0.6 to 3.0 flows over rectangular cavities
[AD-A134579] N84-15121
Study of noise-certification standards for aircraft engines. Volume 1: Noise-control technology for turbofan engines
[AD-A133386] N84-15157
Periodic flow noise reduction using flow-excited resonators: Theory and application --- centrifugal fans
[DFVLR-FB-83-29] N84-15409
Fluid shielding of high-velocity jet noise
[NASA-TP-2259] N84-15894
Aspects of damping of sonic vibrations due to impact loading in plate steels
[BLL-M-35295-(5828.4)] N84-15895
Spinning mode acoustic radiation from the flight inlet
[NASA-CR-172273] N84-15896
Acoustic shocks in a variable area duct containing near sonic flows
[NASA-CR-172274] N84-15897

NONDESTRUCTIVE TESTS
Recognizing defects in carbon-fiber reinforced plastics
[NASA-TM-76947] N84-15143
Metals and ceramics research: Processing, properties, and applications
[ORNL-5943] N84-15187
A new non-destructive and standardless method for the thickness determination of thin films by XRF measurement N84-15308

NONEQUILIBRIUM FLOW
Wet steam flow in L. P. turbines --- low pressure (LP) N84-15483

NONFLAMMABLE MATERIALS
Development of quantitative infrared analysis for monitoring water and emulsifying agents in fire-resistant microemulsion diesel fuels
[AD-A133242] N84-15286

NONLINEAR EQUATIONS
Least squares and domain decompositon methods applied to the numerical solution of nonlinear problems in fluid dynamics N84-15468
A new numerical method for the transient gas-dyanmic code EVENT
[LA-9594-MS] N84-15977

NONLINEAR EVOLUTION EQUATIONS
Bifurcations in nonlinear problems of hydrodynamic instability of plane parallel shear flows N84-15411

NONLINEAR SYSTEMS
Adaptive signal detection for the optimal communications receiver
[AD-A133498] N84-15374
Nonlinear analysis of thin shells by the hybrid mixed finite-element method N84-15578
Nonlinear transformat
[NASA-CR-168506] N84-15877

NONLINEARITY
Nonlinear inverse perturbation method in dynamic redesign N84-15107
User's manual for GAMNAS: Geometric and Material Nonlinear Analysis of Structures
[NASA-TM-85734] N84-15200
Nonlinear viscoelastic characterization of structural adhesives
[NASA-CR-172279] N84-15268
Propellant nonlinear constitutive theory extension: Preliminary results
[AD-A133364] N84-15287
A periodically forced piecewise linear oscillator N84-15577
Theoretical and software considerations for nonlinear dynamic analysis
[NASA-CR-174504] N84-15589

Site-dependent inelastic response spectra N84-15620
Acoustic shocks in a variable area duct containing near sonic flows
[NASA-CR-172274] N84-15897
Nonlinear interaction of toroidicity induced drift modes
[DE84-001562] N84-15987
A study of accretion in compact sources: Disk precession and jet helicity N84-16038

NONPARAMETRIC STATISTICS
A law of the iterated logarithm for non-parametric regression function estimators
[AD-A133260] N84-15847
On jackknifing kernel regression function estimators
[AD-A133236] N84-15867

NORTHERN HEMISPHERE
The causation and variability of the northern winter quasi-stationary planetary waves N84-15705

NORWAY
The Norwegian Seismic Array (NORSAR). Phase 3
[AD-A134038] N84-15713

NOSE WHEELS
FOD (Foreign Object Damage) generation by aircraft tires — probability of engine ingestion and airfield surface movements
[AD-A133319] N84-15146

NOTCHES
Bending elasticity of circularly notched bars as monolithic flexure hinges in precision mechanisms
[DE84-002199] N84-15612

NOZZLE FLOW
Shock associated noise — nozzles N84-15030
Two dimensional condensing flow in transonic turbine cascades N84-15484

NUCLEAR ENERGY
Joint Atomic Information Exchange Group information management project. Briefing outlining functions and specifications of JAIEG automated information management system
[DE84-001800] N84-16082
Joint Atomic Information Exchange Group information management project. Task 2 briefing document. System specification and hardware/software purchase recommendations for JAIEG automated information management system
[DE84-001798] N84-16083

NUCLEAR MAGNETIC RESONANCE
Quantitative determination of hydrogen by pulsed nuclear magnetic resonance spectroscopy
[DE84-002831] N84-15227
Coherent effects in laser spectroscopy N84-15533
An NMR study of solid hydrogen using packer solid echoes and rotating reference frame relaxation N84-15992
High-resolution solid-state (13)C NMR study of the templating cations in tetrapropylammonium fluoride silicalite: The effect of steric interactions
[DE83-011706] N84-16013

NUCLEAR POWER PLANTS
Summary of annual environmental reports for CY 1981: Department of Energy nuclear sites
[DOE/EP-0038/1] N84-15692

NUCLEAR RESEARCH AND TEST REACTORS
Radiation effects in the Joint European Torus Experiment: Guidelines for preliminary design
[R857/2] N84-15971

NUCLEATION
The heterogeneous nucleation of ice I N84-15325

NUCLEI (NUCLEAR PHYSICS)
Low-ionization emission regions in the nuclei of spiral galaxies N84-16100

NULL ZONES
Phase-only nulling at symmetric pattern locations
[AD-A133128] N84-15361
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371

NUMERICAL ANALYSIS
Numerical simulation of separated flows N84-15413
A comprehensive numerical study and experimental verification of endochronic plasticity N84-15579
Analysis of plates by the initial-value method N84-15622
Status of research at the Institute for Computer Applications in Science and Engineering (ICASE)
[NASA-CR-172267] N84-15811
Report and recommendations for improving constitutive relations used in computer codes — shock mechanics in solids
[AD-A133239] N84-15823

NUMERICAL CONTROL
Reflectance measurements, part 2 N84-16028
Computer control of a seven degree of freedom manipulator arm N84-16051

NUMERICAL DATA BASES
FGGE/SBUV tape specification and shipping letter description
[NASA-CR-170482] N84-16071
FGGE/ERBM tape specification and shipping letter description
[NASA-CR-170547] N84-16072
FGGE/ERBZ tape specification and shipping letter description
[NASA-CR-170548] N84-16073

NUMERICAL INTEGRATION
Numerical solution to the steady state equation of transfer in azimuthally symmetric geometries — heat transfer and molecular flow
[DE84-001781] N84-15509

O

O STARS
Line profile variability in winds of OB stars N84-16085

OCEAN BOTTOM
The numerical synthesis and inversion of acoustic fields using the Hankel transform with application to the estimation of the plane wave reflection coefficient of the ocean bottom
[AD-A133156] N84-15901

OCEAN CURRENTS
Ocean wave imaging by SAR N84-15649
Ionospheric factors affecting the performance of HF sky-wave sea-state radars N84-15656
The Canadian programme of experimental measurement of sea-state characteristics by sky-wave radar N84-15657
The nature of microwave backscattering from water waves N84-15665
The long term upper ocean study (LOTUS). Cruise summary and hydrographic data report, ENDEAVOR 97, April 1983
[AD-A134005] N84-15745
Short-term measurements of surface currents associated with the Alboran Sea during Donde Va?
[AD-A133812] N84-15750
XCP measurements off California in October 1982: Cruise report and preliminary results
[AD-A133051] N84-15754

OCEAN DATA ACQUISITIONS SYSTEMS
An analysis of aircraft data collected in the Alboran Sea during Donde Va?, 6 - 18 October 1982
[AD-A133995] N84-15746

OCEAN MODELS
Elliptic solvers for NORDA ocean models and a quasi-geostrophic regional eddy-mean energetics package
[AD-A133754] N84-15751
Results from a two-layer and a reduced gravity model of the Alboran Sea; and vertical shear from tops
[AD-A133753] N84-15752

OCEAN SURFACE
The nature of microwave backscattering from water waves N84-15665
Multiple paths on the ocean surface N84-15666
An analysis of aircraft data collected in the Alboran Sea during Donde Va?, 6 - 18 October 1982
[AD-A133995] N84-15746

OCEAN TEMPERATURE
Ocean temperature changes induced by tropical cyclones N84-15722

OCEANOGRAPHY
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
The nature of microwave backscattering from water waves N84-15665
Alternative experiments using the geophysical fluid flow cell
[NASA-CR-3766] N84-15706
The long term upper ocean study (LOTUS). Cruise summary and hydrographic data report, ENDEAVOR 97, April 1983
[AD-A134005] N84-15745

OCEANS
Ocean temperature changes induced by tropical cyclones N84-15722
The numerical synthesis and inversion of acoustic fields using the Hankel transform with application to the estimation of the plane wave reflection coefficient of the ocean bottom
[AD-A133156] N84-15901

OCTANE NUMBER
1981 CRC octane number requirement survey
[AD-A133369] N84-15288

OFFSHORE PLATFORMS
Wind tunnel tests on a model of a semisubmersible platform and comparison of the results with full-scale data
[NLR-MP-82014-U] N84-15113

OGIVES
Tailored testing theory and practice: A basic model, normal ogive submodels, and tailored testing algorithms
[AD-A133385] N84-15824

ON-LINE PROGRAMMING
PROUST: Knowledge-based program understanding
[AD-A133447] N84-15825

ON-LINE SYSTEMS
Techniques for sensor-based diagnosis
[AD-A133297] N84-15814
The creation of the NLR benchmark package and the performance of two new CDC computers with it
[NLR-MP-82015-U] N84-15819

ONBOARD DATA PROCESSING
Orbital maneuvering vehicle simulation system on-board processing logic N84-16052

ONBOARD EQUIPMENT
AFTI/F-16: An integrated system approach to combat automation N84-15063
Concept of a fighter aircraft weapon delivery system N84-15064
Hardware-in-the-loop simulation techniques used in the development of the Sea Harrier avionic system N84-15071
A small and light weight heat exchanger for on-board helium refrigerator N84-15339
Proton electrostatic analyzer
[AD-A133588] N84-15528
Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space
[NASA-TM-85066] N84-15555
Local area networks: Impact on shipboard applications N84-15888

OPERATIONAL HAZARDS
A systematic characterization of the effects of atmospheric electricity on the operational conditions of aircraft N84-15086

OPERATIONAL PROBLEMS
The analysis of records of parameters: An indispensable tool in oversight and in operations control N84-15082

OPERATIONS RESEARCH
Research in some applied, and the modelling aspects of, reliability theory
[AD-A133424] N84-15567
ISIS: A constraint-directed reasoning approach to job shop scheduling
[AD-A133296] N84-16063
European Scientific Notes. Volume 37, number 9
[AD-A133558] N84-16079

OPERATOR PERFORMANCE
Human visual information processing: Basic viewpoints from psychology and human engineering research
[NLR-MP-82032-U] N84-15798

OPERATORS (MATHEMATICS)
A lower-upper factored implicit scheme for the numerical solution of the Euler equations applied to arbitrary cascades N84-15111
Unified operator description, nonlinear buckling and post-buckling analysis of thin elastic shells
[RUB-IFM-MITT-34] N84-15582

OPTICAL COMMUNICATION
Activities report in communications research performed in cooperation with Higher Institute for Posts and Telegraph (ISPT) N84-15384

OPTICAL COUPLING
On 3He bolometer systems
[NASA-CR-175325] N84-15520
A low loss quasioptical cavity for a two-stage Free Electron Laser (FEL)
[AD-A133321] N84-15541

OPTICAL DATA PROCESSING
Recording and reproduction of microwave holograms using a scanning procedure and their subsequent optical processing
[NASA-TM-77349] N84-15519

OPTICAL EQUIPMENT
In situ characterization of seawater using a computerized suite of optical instruments N84-15675

OPTICAL MEASUREMENT
Advanced techniques of laser telemetry N84-15883
Optical multiple sample vacuum integrating sphere
[NASA-CASE-GSC-12849-1] N84-15960
High precision material study at near millimeter wavelengths
[AD-A133575] N84-15966
Reflectance measurements, part 2 N84-16028

OPTICAL PROPERTIES
The unique surface properties of gold N84-15310
Subpicosecond-relaxation studies using tunable-laser-induced-grating techniques N84-15531
Coherent effects in laser spectroscopy N84-15533

Passive remote sensing of ocean optical propagation parameters N84-15673
Optical flux and polarization spectra compared with radio maps of radio galaxies N84-16093
OPTICAL RADAR
Laser radar analyses [AD-A133295] N84-15540
Lidar remote sensing of internal waves and optical properties N84-15670
OPTICAL RESONATORS
Theory of pulse propagation and coherence in free electron [AD-A133334] N84-15544
OPTICAL THICKNESS
Satellite measurements of marine aerosols N84-15671
OPTIMAL CONTROL
Dynamic control of session input rates in communication networks [AD-A133572] N84-15379
OPTIMIZATION
Optimization of waverider configurations generated from non-axisymmetric flows past a nearly circular cone N84-15108
Composite laminate weight optimization on the HX-20 [AD-A133490] N84-15207
An algorithm for detecting a change in stochastic process [AD-A134104] N84-15842
Optimal reconstructions and n-widths [AD-A133576] N84-15853
Constrained function minimization. Comparison of the augmented Lagrangian and sequentially increasing penalty method [PB83-217265] N84-15863
Technical support for AXAF [NASA-CR-170950] N84-15959
OPTOGALVANIC SPECTROSCOPY
Discharge cell for optogalvanic spectroscopy having orthogonal relationship between the probe laser and discharge axis [NASA-CASE-NPO-16271-1] N84-15537
ORBIT MANEUVERING ENGINE (SPACE SHUTTLE)
An alternate concept for expanding man's presence in space [NASA-TM-84617] N84-15172
ORBITAL MANEUVERING VEHICLES
Orbital maneuvering vehicle simulation system on-board processing logic N84-16052
ORBITAL MANEUVERS
Optimal low thrust, three burn orbit transfers with large plane changes N84-15166
A FMCW radar ranging device for the teleoperator maneuvering system N84-16045
ORBITAL SERVICING
An alternate concept for expanding man's presence in space [NASA-TM-84617] N84-15172
ORBITAL SHOTS
Capture-ejector satellites [NASA-TM-85686] N84-15179
ORBITAL SPACE STATIONS
An alternate concept for expanding man's presence in space [NASA-TM-84617] N84-15172
Capture-ejector satellites [NASA-TM-85686] N84-15179
ORBITAL VELOCITY
Capture-ejector satellites [NASA-TM-85686] N84-15179
ORBITS
Three-dimensional, periodic halo orbits in the restricted three-body problem N84-15167
ORGANIC CHEMISTRY
Activities of the National Chemical Research Laboratory [CSIR-SR-CHEM-261] N84-15188
ORGANIC SEMICONDUCTORS
Immobilization of biomolecules on semiconductor surfaces [FOA-C-40178-C2(B2,A3)] N84-15408
ORGANIZATIONS
Incentives for controlling the performance of high technology and professional employees [AD-A134074] N84-16061
ORGANOMETALLIC COMPOUNDS
Organometallic epitaxy for GaAs/AlGaAs microwave transistors and integrated circuits [AD-A133569] N84-16001
ORTHO HYDROGEN
An NMR study of solid hydrogen using packer solid echoes and rotating reference frame relaxation N84-15992
ORTHOGONAL FUNCTIONS
Discharge cell for optogalvanic spectroscopy having orthogonal relationship between the probe laser and discharge axis [NASA-CASE-NPO-16271-1] N84-15537
ORTHOTROPIC CYLINDERS
Stiffness properties for dynamic modeling of composite graphite-epoxy cylindrical orthotropic shells N84-16054
ORTHOTROPIC PLATES
Investigation of static and dynamic fracture of orthotropic media by photomechanics N84-15625
ORTHOTROPIC SHELLS
Stiffness properties for dynamic modeling of composite graphite-epoxy cylindrical orthotropic shells N84-16054
OSCILLATING FLOW
Effects of unsteadiness on turbulent boundary layers N84-15457
OSCILLATIONS
The effect of flow oscillations on cavity drag, and a technique for their control N84-15109
Nonlinear acoustics instabilities in combustion chambers N84-15230
An experimental study of steady and pulsating heat transfer in curved tubes N84-15515
OSCILLATORS
A periodically forced piecewise linear oscillator N84-15577
OVER-THE-HORIZON RADAR
HF over-the-horizon mapping of the Greenland icecap N84-15654
Automatic electron density profiles from digital ionograms N84-15659
OXIDATION
Chemical kinetics modeling of engine knock: Preliminary results [DE84-001236] N84-15226
Trichite growth during oxidation of titanium and TA6V4 alloy by water vapor at high temperatures [NASA-TM-76974] N84-15248
Oxygen adsorption and initial oxidation of single crystal first row transition metal and alloy surfaces N84-15316
Fabrication and properties of multilayer structures [NASA-CR-174506] N84-15997
OXIDATION-REDUCTION REACTIONS
New polyconjugated oxidation-reduction polymers, as well as a method and apparatus for electrochemical regeneration [DE84-002813] N84-15276
OXIDE FILMS
Surface coating systems for copper and copper alloys N84-15311
OXIDIZERS
Combustion at the interface of an oxidizer-fuel slab system N84-15215
OXYGEN
Atomic oxygen effects on materials N84-16036
OXYGEN CONSUMPTION
Differentiated ratings of perceived exertion and selected physiological responses during prolonged upper and lower body exercise [AD-A134086] N84-15769
OXYGEN METABOLISM
Increased metabolism and dead space as components of ventilation at high altitude [AD-A130827] N84-15766
OZONE
FGGE/SBUV tape specification and shipping letter description [NASA-CR-170482] N84-16071

P

PACIFIC NORTHWEST (US)
Pacific Northwest solar radiation data [DE84-002335] N84-15738
PACIFIC OCEAN
Magnetic anomalies in east Pacific using MAGSAT data [E84-10060] N84-15630
Results from a two-layer and a reduced gravity model of the Alboran Sea; and vertical shear from tops [AD-A133753] N84-15752
PACKET SWITCHING
Low rate transmission of video signals using adaptive delta modulation [AD-A133145] N84-15363
Advanced teleprocessing systems [AD-A133525] N84-15375
PACKETS (COMMUNICATION)
Low rate transmission of video signals using adaptive delta modulation [AD-A133145] N84-15363
Advanced teleprocessing systems [AD-A133525] N84-15375
Advanced teleprocessing systems [AD-A133555] N84-15378
PACKING DENSITY
Calculation of structure factor for different cluster models of an amorphous alloy [BLL-M-35293-(5828.4)] N84-15234
PAIR PRODUCTION
Cross section estimates for multi-TeV physics N84-15914
PALLADIUM COMPOUNDS
Fabrication and properties of multilayer structures [NASA-CR-174506] N84-15997
PANEL METHOD (FLUID DYNAMICS)
Some new developments in exact integral equation formulations for sub- or transonic potential flow [NLR-MP-82024-U] N84-15860
PARABOLIC DIFFERENTIAL EQUATIONS
Finite difference methods for convective-diffusive equations N84-15432
PARABOLIC REFLECTORS
Direct steam generation in line-focus solar collectors [DE83-006030] N84-15678
Determination of freeze protection heat loss from a parabolic trough solar system [DE84-000005] N84-15689
PARACHUTES
High-speed, low-altitude payload delivery using a single large ribbon parachute [DE84-002731] N84-15128
PARADOXES
Comment on the extinct paradox [NASA-TM-85113] N84-15958
PARALLEL FLOW
The effects of acoustic excitation on the mixing of two parallel laminar streams of fluid [AD-A126788] N84-15502
PARALLEL PROCESSING (COMPUTERS)
Analysis of data flow for SIMD (Single Instruction Multiple Data) systems [AD-A133248] N84-15812
PARAMETER IDENTIFICATION
The measurement of surface texture and its correlation with function N84-15299
PARAMETERIZATION
Experimental designs for quantal response models [AD-A133416] N84-15851
The 2-stage selection procedures based on tests [AD-A133405] N84-15871
PARTIAL DIFFERENTIAL EQUATIONS
Nonlinear Green's function method for transonic potential flow N84-15104
The theory of an active magnetic regenerative refrigerator N84-15351
Asymptotic analysis of numerical wave propagation in finite difference equations [NASA-CR-175323] N84-15360
Solution of elastic and elasto-plastic problems by the method of lines N84-15573
Numerical methods for tracking interfaces [DE84-001730] N84-15854
Explicit second order splitting schemes for solving hyperbolic nonlinear problems: Theory and application to transonic flow [ESA-TT-768] N84-15855
PARTICLE ACCELERATION
On the relationship between collisionless shock structure and energetic particle acceleration [NASA-CR-175328] N84-15909
Non-stochastic acceleration of protons in the magnetic neutral sheet [IPPJ-646] N84-15975
PARTICLE ACCELERATORS
Proceedings of the 1983 DPF Workshop on Collider Detectors: Present Capacities and Future Possibilities [LBL-15973] N84-15911
Search for Hadron jets and large transverse momentum electrons at the SPS pp collider N84-15913
Trigger systems which could operate at a luminosity of 10/sup 33 cm(-2) to sec/sup -1 N84-15918
Detectors at 20 TeV and detector considerations for a high luminosity hadron-hadron machine N84-15920
Finite geometry effects on the stability of a charged beam propagating through a relativistic annular electron beam [AD-A133338] N84-15948
PARTICLE COLLISIONS
Simultaneous electron capture and excitation in ion-atom collisions [DE83-005799] N84-15907
Track chambers for high luminosity N84-15921
TOF for heavy stable particle identification N84-15936
Thermal electron heating rate: A derivation [NASA-TM-85124] N84-15941
Experimental studies of secondary ion emission from well-characterized surfaces [AD-A133186] N84-15943

Differences between positrons and electrons in elastic and inelastic processes at surfaces
[DE84-001208] N84-15953
Collisional-radiative model for helium-like ions: Application to intermediate-density plasmas
[IPPJ-847] N84-15976

PARTICLE INTERACTIONS
Searching for limitations in capability due to high average rates N84-15919

PARTICLE PRODUCTION
TOF for heavy stable particle identification N84-15936

PARTICLE SIZE DISTRIBUTION
Atomization and mixing study
[NASA-CR-170943] N84-15284
Development of theoretical models and analyses of the micro-physics of cloud and precipitation systems
[AD-A133557] N84-15735
Determination of particle-size distribution by measuring the transmission of an aerosol in sedimentation
[AD-A133288] N84-15962
Mie code AGAUS 82
[AD-A133489] N84-15964

PARTICLE TRACKS
The problem of tracking charged particles in the cores of high energy jets in a high rate environment N84-15916
Trigger systems which could operate at a luminosity of 10/sup 33 cm(-2) to sec/sup -1 N84-15918
Track chambers for high luminosity N84-15921

PARTICLE TRAJECTORIES
Proceedings of the 1983 DPF Workshop on Collider Detectors: Present Capacities and Future Possibilities
[LBL-15973] N84-15911

PARTICLES
Status of research in progress at the Inhalation Toxicology Research Institute
[DE83-012610] N84-15694
Scattering and absorption of light by soot particles
[DE84-002306] N84-15967

PARTONS
Angular coverage of detectors N84-15940

PASSIVITY
Potentiostatic investigation of the kinetics of the breakdown of the passivity of aluminium in aqueous medium
[BLL-OA-TRANS-3066-(6196.3)] N84-15238

PATTERN RECOGNITION
Battery lifetime prediction by pattern recognition application to lead-acid battery life-cycling test data
[AD-A133281] N84-15397
Eddy detection within turbulent shear flows N84-15453
Moment estimators of defect pattern frequencies, allowing for inspection error
[AD-A133487] N84-15568

PATTERNS
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371

PAVEMENTS
Microwave methods and apparatus for paving and paving maintenance
[DE84-016306] N84-15359

PAYLOAD INTEGRATION PLAN
Payload missions integration
[NASA-CR-170949] N84-15171

PAYLOADS
High-speed, low-altitude payload delivery using a single large ribbon parachute
[DE84-002731] N84-15128

PENALTY FUNCTION
Constrained function minimization. Comparison of the augmented Lagrangian and sequentially increasing penalty method
[PB83-217265] N84-15863

PENNSYLVANIA
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields — California and Pennsylvania
[E84-10057] N84-15628
Synthesis of regional crust and upper-mantle structure from seismic and gravity data
[E84-10061] N84-15631

PERCEPTION
The perceptual component of relationships in library networks N84-16070

PERFORMANCE
A general computer model for predicting the performance of gas sorption refrigerators N84-15349

PERFORMANCE TESTS
Aerodynamics, aeroelasticity, and stability of hang gliders N84-15134
Life test performance of a Philips rhombic-drive refrigerator with bellows seals N84-15341
The creation of the NLR benchmark package and the performance of two new CDC comuters with it
[NLR-MP-82015-U] N84-15819

PERIODIC VARIATIONS
Periodic spectral variation in Cygnus X-2 and Scorpius X-1 N84-16088

PERMEABILITY
Permeability of flexible materials used in fuel storage tanks. Part 2: A method of measurement and preliminary results
[AD-A133451] N84-15558
Ultrahigh molecular weight aromatic siloxane polymers N84-16042

PERMEATING
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246

PERSONALITY
Influences on group productivity. 2: Factors inherent in the person. A bibliographic synopsis
[AD-A131015] N84-15790

PERSONNEL
Job attitudes toward the new maintenance concept of the airway facilities service
[AD-A133282] N84-15793
Perspectives on oversight management of software development projects
[AD-A133404] N84-16064

PERSONNEL DEVELOPMENT
Evaluation results for the interactive video competency recognition system
[AD-A133052] N84-15796
Artificial intelligence: An analysis of potential applications to training, performance measurement, and job performance aiding
[AD-A133592] N84-15839

PERSONNEL MANAGEMENT
Performance appraisal revisited
[AD-A132841] N84-16059
The design of effective reward systems
[AD-A132859] N84-16067
Organizational-climate dimensions: A conceptual and judgmental analysis
[AD-A132898] N84-16068

PERSPIRATION
Heat exchange following atropine injection before and after heat acclimation
[AD-A132618] N84-15780

PERTURBATION
Nonlinear inverse perturbation method in dynamic redesign N84-15107
Coherent effects in laser spectroscopy N84-15533
Development and perturbation analysis of model stochastic equations for global circulation N84-15743
Monte Carlo simulation of high p/sub P jets N84-15915

PHASE COHERENCE
Theory of pulse propagation and coherence in free electron
[AD-A133334] N84-15544

PHASE DIAGRAMS
Study of phase diagrams of ternary semiconductors
[AD-A133556] N84-16000

PHASE SHIFT CIRCUITS
Rivista Tecnica Selenia, volume 8, number 2, 1982 N84-15882
A digital ferrite phase-shifter for high power S-band operation N84-15886

PHASE TRANSFORMATIONS
Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy
[DE84-001985] N84-15257
New polymers for low-gravity purification of cells by phase partitioning
[NASA-CR-170957] N84-15267
Specific heat of He-3 in the Fermi liquid region
[DE83-011566] N84-16009
Project objectives and progress at the Research Laboratory of Electronics
[RLE-125] N84-16016
Determination of systems suitable for study as monotectic binary metallic alloy solidification models N84-16050

PHASE VELOCITY
Numerical simulations of convectively excited gravity waves
[DE84-001867] N84-15718

PHASED ARRAYS
The Norwegian Seismic Array (NORSAR). Phase 3
[AD-A134038] N84-15713

PHENYLS
Chemistry, characterization and processing of IMC curing polymers
[AD-A133479] N84-15274

PHOSPHINES
Phosphorous-containing imide resins — flame resistant composite materials
[NASA-CASE-ARC-11368-3] N84-15202

PHOSPHORUS OXIDES
Phosphorous-containing imide resins — flame resistant composite materials
[NASA-CASE-ARC-11368-3] N84-15202

PHOTOCATHODES
Nanosecond image-shuttering studies at Los Alamos National Laboratory
[DE84-001733] N84-15405

PHOTOCHEMICAL REACTIONS
Basic vision events
[AD-A132746] N84-15782
Primary events in vision - investigation of basic eye responses
[AD-A132747] N84-15783

PHOTODISSOCIATION
Vacuum ultraviolet photofragmentation of H2O and NO2: Laboratory studies and atmospheric applications N84-15703

PHOTOELASTIC ANALYSIS
A three-dimensional photoelastic investigation of stresses and cracks formed in concrete around deformed reinforcing bars N84-15621

PHOTOELECTRIC EMISSION
Emission of short-wavelength photons from ion-surface charge exchange
[AD-A133183] N84-15942

PHOTOELECTRON SPECTROSCOPY
Photoelectron studies of resonant multiphoton ionization of CO via the A-1 Pi state
[DE83-008535] N84-15956

PHOTOELECTRONS
Transport processes in planetary atmospheres N84-16104

PHOTOGEOLOGY
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields — California and Pennsylvania
[E84-10057] N84-15628

PHOTOGRAPHY
Use of LANDSAT MSS (multispectral scanner) digital data in water quality mapping of the Neuse River estuary, North Carolina
[PB83-256750] N84-15645

PHOTOIONIZATION
Photoelectron studies of resonant multiphoton ionization of CO via the A-1 Pi state
[DE83-008535] N84-15956

PHOTOLUMINESCENCE
Surface photoluminescence and it application N84-15304

PHOTOMECHANICAL EFFECT
Investigation of static and dynamic fracture of orthotropic media by photomechanics N84-15625

PHOTONS
Emission of short-wavelength photons from ion-surface charge exchange
[AD-A133183] N84-15942

PHOTOVOLTAIC CONVERSION
USAF advanced terrestrial energy study. Volume 2: Technology handbook
[AD-A133272] N84-15684
USAF advanced terrestrial energy study. Volume 4: Analysis, data, and bibliography
[AD-A133514] N84-15686

PHYSICAL CHEMISTRY
Activities of the National Chemical Research Laboratory
[CSIR-SR-CHEM-261] N84-15188

PHYSICAL EXERCISE
Stress fractures: The remodelling response to excessive repetitive loading
[AD-A130881] N84-15765
Increased metabolism and dead space as components of ventilation at high altitude
[AD-A130827] N84-15766
Differentiated ratings of perceived exertion and selected physiological responses during prolonged upper and lower body exercise
[AD-A134086] N84-15769

PHYSIOCHEMISTRY
Countercurrent distribution of biological cells
[NASA-CR-170958] N84-15755

PHYSIOLOGICAL EFFECTS
The effects of dehydration on peripheral cooling
[AD-A130838] N84-15767
Differentiated ratings of perceived exertion and selected physiological responses during prolonged upper and lower body exercise
[AD-A134086] N84-15769

PHYSIOLOGICAL FACTORS
Physiological and psychological aspects of the piloting of modern high-performance combat aircraft N84-15099
PHYSIOLOGICAL RESPONSES
Evaluation of factors producing visual evoked response variability
[AD-A133917] N84-15772
Neurobehavioral effects of carbon monoxide (CO) exposure in humans protocol 1
[AD-A133891] N84-15774
PICOSECOND PULSES
Subpicosecond-relaxation studies using tunable-laser-induced-grating techniques N84-15531
PIEZOELECTRIC TRANSDUCERS
The use of matrix transducers in medium thickness welding inspection
[CISE-2075] N84-15572
PILOT PERFORMANCE
A study on airborne integrated display system and human information processing
[NASA-TM-77338] N84-15789
PILOTS (PERSONNEL)
Pilot human factors in stall/spin accidents of supersonic fighter aircraft N84-15102
PIPE FLOW
Finite element analysis of fluid-filled elastic piping systems N84-15600
PIPES (TUBES)
Biaxial fatigue of graphite/epoxy + or - 45 sub s tubes N84-15210
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246
Plastic flows of tubes and blocks N84-15421
The core region of channel flows N84-15452
Fracture resistance of hardened and tempered pipes of 16GFR steel
[BLL-M-35268-(5826.4)] N84-15584
Plane strain fracture toughness of polyethylene pipe materials
[MIT-RR-R2-2] N84-15586
Finite element analysis of fluid-filled elastic piping systems N84-15600
PISTONS
Split-Stirling, linear-resonant, cryogenic refrigerators for detector cooling N84-15342
PITTING
Potentiostatic investigation of the kinetics of the breakdown of the passivity of aluminium in aqueous medium
[BLL-OA-TRANS-3066-(6196.3)] N84-15238
Pit initiation resistance of ferritic stainless steels in chloride environments from 800 to 2600C
[DE84-000355] N84-15258
Evaluation of the pitting corrosion resistance of a Fe-12% Cr alloy N84-15321
PLANE STRAIN
Finite element and boundary element analysis of large strain large displacement problems in elastoplasticity N84-15580
PLANE WAVES
The relation between power and energy in the shock initiation of detonations. 1: Basic theoretical considerations and the effects of geometry
[AD-A133468] N84-15505
The numerical synthesis and inversion of acoustic fields using the Hankel transform with application to the estimation of the plane wave reflection coefficient of the ocean bottom
[AD-A133156] N84-15901
PLANETARY ATMOSPHERES
Transport processes in planetary atmospheres N84-16104
PLANETARY EVOLUTION
Some issues related to evolution of planetary atmospheres N84-16103
PLANETARY MANTLES
Seismic properties of the crust and uppermost mantle of North America
[NASA-CR-175134] N84-15708
PLANETARY NEBULAE
Part 1: Physical studies of distant comets. Part 2: Morphologies of planetary nebulae N84-16091
PLANETARY WAVES
The causation and variability of the northern winter quasi-stationary planetary waves N84-15705
PLANKTON
A preliminary survey of plankton and periphyton in the Turn Barge Canal and basin area of Kennedy Space Center, Florida N84-16027
PLANNING
Local automation model: Functional description
[AD-A133389] N84-16077
PLASMA ACCELERATORS
An investigation of accelerating mechanisms in a plasma focus relevant to interrupting switches
[AD-A133462] N84-15983
PLASMA CONTROL
On laser air breakdown, threshold power and laser generated channel length
[AD-A133211] N84-15538
PLASMA CURRENTS
Dissipation of magnetic energy during disruptive current termination — disruptions in tokamak reactors
[IPPJ-644] N84-15973
Computations of the current profile influence on tearing instability
[NASA-TM-77285] N84-159[illegible]
PLASMA DIAGNOSTICS
Hydrogen ignition for laser propulsion N84-16026
PLASMA DRIFT
Microinstabilities in the high latitude F region: A brief review
[DE84-001709] N84-15719
PLASMA EQUILIBRIUM
Equilibrium studies for low-aspect-ratio torsatrons
[DE84-002264] N84-15979
PLASMA FOCUS
An investigation of accelerating mechanisms in a plasma focus relevant to interrupting switches
[AD-A133462] N84-15983
PLASMA INTERACTIONS
Thermal and electrical interaction of tantalum with a low temperature chemically active plasma flow
[NASA-TM-77374] N84-15980
PLASMA JETS
Monte Carlo simulation of high p/sub P jets N84-15915
The problem of tracking charged particles in the cores of high energy jets in a high rate environment N84-15916
PLASMA PHYSICS
A multipurpose production controller for plasma physics codes
[LA-9477-MS] N84-15978
PLASMA PINCH
Sustained self-reversal in the reversed field pinch
[DE84-001559] N84-15990
PLASMA SPECTRA
Collisional-radiative model for helium-like ions: Application to intermediate-density plasmas
[IPPJ-647] N84-15976
PLASMA SPRAYING
Preliminary investigation of ceramic-coated anodes for cathodic protection
[AD-A133440] N84-15273
PLASTIC DEFORMATION
Plastic flows of tubes and blocks N84-15421
PLASTIC FLOW
Plastic flows of tubes and blocks N84-15421
PLASTIC MEMORY
Volume recovery in glasses: A free-volume diffusion process
[DE83-013771] N84-15280
PLASTIC PROPERTIES
A comprehensive numerical study and experimental verification of endochronic plasticity N84-15579
PLATES (STRUCTURAL MEMBERS)
Nonlinear analysis of thin shells by the hybrid mixed finite-element method N84-15578
A comprehensive numerical study and experimental verification of endochronic plasticity N84-15579
An alternative method of analysis for base accelerated dynamic response in NASTRAN N84-15598
Analysis of plates by the initial-value method N84-15622
PLATING
Ion plating in corrosion protection
[DE84-001182] N84-15256
PLATINUM COMPOUNDS
Inorganic chemistry N84-15192
PLUGS
A report on superfluid helium flow through porous plugs for space science applications N84-16043
PLY ORIENTATION
Fracture behavior of unidirectional boron/aluminum composite laminates
[NASA-CR-3753] N84-15196
PNEUMATIC EQUIPMENT
Jet-impact nebulization for sample introduction in inductively coupled plasma spectrometry
[AD-A133152] N84-15982
POINT SPREAD FUNCTIONS
Thematic mapper radiomtric variability on ostensibly uniform agricultural scenes
[E84-10035] N84-15626
POINTING CONTROL SYSTEMS
Fine pointing control of the solar UV telescope on the sounding rocket S-520-5
[ISAS-608] N84-16094
POLAR WANDERING (GEOLOGY)
Nonuniformity of the Earth's rotation and the motion of the poles
[NASA-TM-77337] N84-15709
POLARIZATION (SPIN ALIGNMENT)
Laser optical pumping of sodium and lithium atom beams N84-15534
POLARIZATION CHARACTERISTICS
The influence of weakly polarized surfaces on different kinds of thin layer systems N84-15309
Optical flux and polarization spectra compared with radio maps of radio galaxies N84-16093
POLARIZED RADIATION
Use of synchrotron radiation for electron identification at high luminosity N84-15935
POLYACETYLENE
Electron-electron interactions and broken symmetry in one dimension
[DE84-001704] N84-16014
POLYCRYSTALS
Electrical conductivities of polycrystalline and single-crystal Er2O3-stabilized hafnia
[DE83-017681] N84-15279
A formula for the sputtering yield of polycrystalline materials N84-15313
Progress in polycrystalline thin-film solar cells
[DE83-012131] N84-15691
POLYETHYLENES
Plane strain fracture toughness of polyethylene pipe materials
[MIT-RR-R2-2] N84-15586
Countercurrent distribution of biological cells
[NASA-CR-170958] N84-15755
POLYIMIDE RESINS
Phosphorous-containing imide resins --- flame resistant composite materials
[NASA-CASE-ARC-11368-3] N84-15202
Chemistry, characterization and processing of IMC curing polymers
[AD-A133479] N84-15274
POLYMER MATRIX COMPOSITES
The influence of the environment on the mechanical characteristics of composite materials: Design considerations --- polymer matrix composites
[INTA-INFORME-I-1/221/720/83047] N84-15281
POLYMERIC FILMS
Polymer coated electrodes in ambient temperature molten salts
[AD-A133202] N84-15220
Surface coating systems for copper and copper alloys N84-15311
POLYMERIZATION
The preparation and properties of porous glass-polymer composite N84-15261
Synthesis and characterization of some thermotropic nematic and cholesteric polymers N84-15262
New polyconjugated oxidation-reduction polymers, as well as a method and apparatus for electrochemical regeneration
[DE84-002813] N84-15276
European Scientific Notes. Volume 37, number 9
[AD-A133558] N84-16079
POLYMERS
Relationship between the glass transition temperature and the chemical structure of polymers
[RAE-LIB-TRANS-2098] N84-15265
New polymers for low-gravity purification of cells by phase partitioning
[NASA-CR-170957] N84-15267
Crazing and fatigue behaviour of one and two phase polymers N84-15282
Ultrahigh molecular weight aromatic siloxane polymers N84-16042
POLYNOMIALS
The travelling salesman problem in graphs with 3-edge cutsets
[AD-A133504] N84-15852
POLYSTYRENE
Evaluation of the separability of monodisperse polystyrene latex microspheres in a continuous flow electrophoresis system N84-16057
POLYURETHANE FOAM
Evaluation of type 2 fast packs for electrostatic discharge properties
[AD-A133158] N84-15557
POLYVINYL CHLORIDE
The influence of surface roughness on the transfer and wear of polymers
[AD-A133527] N84-15275

POPULATION THEORY
On Bayes and empirical bayes rules for selecting good populations
[AD-A133336] N84-15869
An estimation problem relating to subset selection for normal populations
[AD-A133387] N84-15870
Population control of self-replicating systems: Option C N84-16044
POROSITY
A report on superfluid helium flow through porous plugs for space science applications N84-16043
POSITION (LOCATION)
Geophysical data from drifting ice stations FRAM 4 and TRISTEN
[AD-A133370] N84-15640
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15861
Spatiotemporal characteristics of visual localization
[AD-A133952] N84-15770
Spatial localization in strabismic observers
[AD-A132748] N84-15784
A review of underwater acoustic systems and methods for locating objects lost at sea
[NASA-TM-85727] N84-15898
POSITION INDICATORS
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
POSITRON ANNIHILATION
Differences between positrons and electrons in elastic and inelastic processes at surfaces
[DE84-001208] N84-15953
POTENTIAL FLOW
Nonlinear Green's function method for transonic potential flow N84-15104
Calculation of transonic flow around two wing-fuselage combinations using a full potential equation method
[FFA-137] N84-15132
Characterization of the pressure wave originating in the explosion of a gas cloud N84-15446
Numerical computation of transonic flow governed by the full-potential equation N84-15469
Numerical modeling and fast-solver calculation of approximately normal shocks
[NLR-MP-82026-U] N84-15856
Some new developments in exact integral equation formulations for sub- or transonic potential flow
[NLR-MP-82024-U] N84-15860
POTENTIAL THEORY
Iterative solution of the finite difference potential equations for subsonic and transonic flows N84-15436
Finite element methods for potential flows N84-15437
POTENTIOMETRIC ANALYSIS
Potentiostatic investigation of the kinetics of the breakdown of the passivity of aluminium in aqueous medium
[BLL-OA-TRANS-3066-(6196.3)] N84-15238
POWDER (PARTICLES)
Screening and classification of ceramic powders
[NASA-TM-77092] N84-15270
POWDER METALLURGY
Powder metallurgy
[BLL-M-35271-(5828.4)] N84-15231
Rapid solidification processing and powder metallurgy of Al alloys
[AD-A133873] N84-15250
POWER PLANTS
Influence of Ar + CO2 shielding on the composition of a Cr-Mo-V weld
[BLL-CE-TRANS-8000-(9022.09)] N84-15550
POWER REACTORS
Pit initiation resistance of ferritic stainless steels in chloride environments from 800 to 2600C
[DE84-000355] N84-15258
POWER SERIES
The generalized Euler-Mascheroni constants
[NASA-TP-2264] N84-15880
POWER SUPPLIES
Thermohydraulic applications of liquid metals in the non-nuclear field N84-15501
Novette pulse-power-system description
[DE83-018185] N84-15968
Current collection from the space plasma through defects in high voltage solar array insulation N84-15970
PRECIPITATION (CHEMISTRY)
Precipitation of metals from solutions by baser metals
[CSIR-1712] N84-15242
PRECIPITATION (METEOROLOGY)
Utilization of satellite data in mesoscale models of severe weather
[NASA-CR-175122] N84-15730
Development of theoretical models and analyses of the micro-physics of cloud and precipitation systems
[AD-A133557] N84-15735
PRECIPITATION HARDENING
Use of the disk bend test to assess irradiation performance of structural alloys
[DE84-001484] N84-15255
PREDICTION ANALYSIS TECHNIQUES
The effect of superposing ripple loading of maneuver load cycles
[AD-A132653] N84-15148
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169
Battery lifetime prediction by pattern recognition application to lead-acid battery life-cycling test data
[AD-A133281] N84-15397
Aerodynamics and steam wetness fraction of a multistage turbine. Comparison of prediction with experimental data N84-15475
Applications of through-flow theory --- steam turbines N84-15477
Steam condenser thermal design theories N84-15485
Turbulence modeling in liquid metal free convection --- in reactor cooling systems N84-15490
Cross section estimates for multi-TeV physics N84-15914
PREDICTIONS
TAS: A Transonic Aircraft/Store flow field prediction code
[NASA-CR-3721] N84-15114
Finite element analysis of fluid-filled elastic piping systems N84-15600
Data analysis and theoretical studies for atmospheric Explorer C, D and E
[NASA-CR-175121] N84-15711
A comparison of NMC models (1977) on precipitation forecasts for east coast cyclogenesis N84-15720
Comparison of IRT observed-score and true-score equatings
[AD-A133871] N84-15791
PREFLIGHT ANALYSIS
Preflight transient dynamic analyses of B-52 aircraft carrying Space Shuttle solid rocket booster drop-test vehicle
[NASA-TM-84925] N84-15588
PREMIXED FLAMES
A review of theories currently being used to model steady plane flames on flame-holders
[CA-8316] N84-15218
Second order theory of unsteady burned-anchored flames with arbitrary Lewis number
[CA-8313] N84-15219
Transport algorithms for methane flames
[AD-A133213] N84-15221
PRESSURE DEPENDENCE
Role of pressure in understanding the anomalous superconductivity in europium (molybdenum)6(sulfur)8 and (TMTSF)2FSO3
[DE83-017292] N84-16012
PRESSURE DISTRIBUTION
Calculation of transonic flow around two wing-fuselage combinations using a full potential equation method
[FFA-137] N84-15132
Propagating plane harmonic waves through finite length plates of variable thickness using finite element techniques N84-15601
PRESSURE DROP
Tube vibration in industrial-size test heat exchanger (90 deg square layout)
[DE83-011931] N84-15614
PRESSURE EFFECTS
Effects of unsteadiness on turbulent boundary layers N84-15457
PRESSURE GRADIENTS
Stirling engines with controlled evaporation of a two-phase two-component working fluid
[DE83-017284] N84-15560
PRESSURE MEASUREMENT
Calibration of air-data systems and flow direction sensors. AGARD Flight Test Techniques Series, volume 1
[AGARD-AG-300-VOL-1] N84-15530
PRESSURE SENSORS
Calibration of air-data systems and flow direction sensors. AGARD Flight Test Techniques Series, volume 1
[AGARD-AG-300-VOL-1] N84-15530
PRESSURE SUITS
Interaction of anti-G measures and chest wall mechanics in determining gas exchange
[AD-A133740] N84-15775
PRINTED CIRCUITS
Automatic inspection for printed wiring
[AD-A133328] N84-15566
PROBABILITY DENSITY FUNCTIONS
Fitting a multiple regression function
[AD-A133482] N84-15874
PROBABILITY DISTRIBUTION FUNCTIONS
Some properties of a 5-parameter bivariate probability distribution
[NASA-TM-82550] N84-15866
PROBABILITY THEORY
An estimation problem relating to subset selection for normal populations
[AD-A133387] N84-15870
Ambiguity and uncertainty in probabilistic inference
[AD-A133418] N84-15872
PROBLEM SOLVING
Integrated circuit failure mechanism detected by IMMA N84-15305
Asymptotic analysis of numerical wave propagation in finite difference equations
[NASA-CR-175323] N84-15360
Exploiting temporal knowledge to organize constraints
[AD-A133417] N84-15838
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics
[AD-A133142] N84-15843
An investigation of the use of iterative linear equation solvers in codes for large stiff systems of ODE's
[AD-A133189] N84-15845
A new numerical method for the transient gas-dyanmic code EVENT
[LA-9594-MS] N84-15977
PRODUCT DEVELOPMENT
4.0 K cryocooler project
[DE84-000332] N84-15358
PRODUCTION
Production networks: A dynamic model of production
[AD-A133571] N84-16065
PRODUCTION ENGINEERING
Powder metallurgy
[BLL-M-35271-(5828.4)] N84-15231
Trends in steam turbine design, testing and manufacturing N84-15478
The human side of robotics: Results from a prototype study on how workers react to a robot
[AD-A133438] N84-15805
PRODUCTION MANAGEMENT
Integrated evaluation of the quality of steel cable wire
[BLL-M-35267-(5828.4)] N84-15564
PRODUCTION PLANNING
ISIS: A constraint-directed reasoning approach to job shop scheduling
[AD-A133296] N84-16063
PRODUCTIVITY
Influences on group productivity. 2: Factors inherent in the person. A bibliographic synopsis
[AD-A131015] N84-15790
Organizational outcomes of creativity
[AD-A132825] N84-16066
PROFILES
Quantitative sputter profiling at surfaces and interfaces N84-15314
Depth resolution due to instrumental factors in sputter-assisted depth profiling N84-15315
PROGRAM VERIFICATION (COMPUTERS)
Validation of digital systems in avionics and flight control applications handbook, volume 1
[AD-A133222] N84-15150
PROUST: Knowledge-based program understanding
[AD-A133447] N84-15825
PROGRAMMERS
Classifying bugs is a tricky business
[AD-A133264] N84-15813
PROGRAMMING LANGUAGES
Efficient demand-driven evaluation
[AD-A133477] N84-15827
PROJECT MANAGEMENT
Advanced automation program. Program master plan
[DOT/FAA/AP-83/3] N84-15139
PROJECTIVE GEOMETRY
Use of 3D graphics in scientific data analysis
[DE84-000911] N84-15831
PROPAGATION
Beam propagation experimental study
[AD-A133310] N84-15946
PROPAGATION MODES
Statistical data on anomalous propagation in the Tyrrhenian Sea using an X-band link N84-15668
A long range propagation experiment to investigate the incidence of anomalous propagation in the north Atlantic N84-15669
Passive remote sensing of ocean optical propagation parameters N84-15673

PROPELLERS
Research towards and development of aerospace vehicle noise certification with emphasis on propeller aircraft and helicopters N84-15026
NASTRAN documentation for flutter analysis of advanced turbopropellers [NASA-CR-167927] N84-15153
PROPORTIONAL COUNTERS
The performance of 16000 wire mini-drift MWPC system N84-15922
PROPULSION SYSTEM CONFIGURATIONS
Propulsion apparatus and method using boil-off gas from a cryogenic liquid --- controlling spacecraft attitude and drag [NASA-CASE-MFS-25946-1] N84-15183
PROTECTIVE COATINGS
Methods in competition with electroplating [BLL-OA-TRANS-3037-(6196.3)] N84-15213
Development of an improved protective cover/light block for multilayer insulation [NASA-TM-82563] N84-15269
The use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition N84-15307
Surface coating systems for copper and copper alloys N84-15311
PROTONS
Proton electrostatic analyzer [AD-A133588] N84-15526
Non-stochastic acceleration of protons in the magnetic neutral sheet [IPPJ-646] N84-15975
Studies of neutron and proton nuclear activation in low-Earth orbit 2 N84-16041
PROVING
Automating the testing of software N84-15074
PSYCHOLOGICAL EFFECTS
A comparison of map learning methods: Map study, simulated travel and mixed [AD-A133544] N84-15794
PSYCHOLOGICAL FACTORS
Physiological and psychological aspects of the piloting of modern high-performance combat aircraft N84-15099
Neurobehavioral effects of carbon monoxide (CO) exposure in humans protocol 1 [AD-A133891] N84-15774
The human side of robotics: Results from a prototype study on how workers react to a robot [AD-A133438] N84-15805
Organizational-climate dimensions: A conceptual and judgmental analysis [AD-A132898] N84-16068
PSYCHOLOGICAL TESTS
Comparison of IRT observed-score and true-score equatings [AD-A133871] N84-15791
PSYCHOLOGY
Applied psychology in Europe: An ONR perspective [AD-A133093] N84-15797
PULSE AMPLITUDE
Video processor for air traffic control beacon system [NASA-CASE-KSC-11155-1] N84-15395
PULSE COMMUNICATION
Digital communication in the presence of impulsive noise N84-15392
PULSE GENERATORS
Theory of pulse propagation and coherence in free electron [AD-A133334] N84-15544
Novette pulse-power-system description [DE83-018185] N84-15968
PULSED LASERS
Analysis of short pulse laser altimetry data obtained over horizontal path [NASA-CR-170612] N84-15535
Copper vapor laser scale demonstration [AD-A133327] N84-15543
PULSED RADIATION
Novette pulse-power-system description [DE83-018185] N84-15968
PULSES
An experimental study of steady and pulsating heat transfer in curved tubes N84-15515
The harmonic structure of PC 3-4 magnetic pulsations at geosynchronous orbit and its relation to the solar wind N84-16106
PURIFICATION
New polymers for low-gravity purification of cells by phase partitioning [NASA-CR-170957] N84-15267
PYROPHORIC MATERIALS
Heat-storage materials for IRCM [AD-A133110] N84-15961

Q

QUADRATIC EQUATIONS
Synthesis of insensitive controllers in linear quadratic control problems [REPT-605] N84-15841
QUALIFICATIONS
Color perception and ATC job performance [AD-A132649] N84-15781
QUALITY
Integrated evaluation of the quality of steel cable wire [BLL-M-35267-(5828.4)] N84-15564
QUALITY CONTROL
Integrated evaluation of the quality of steel cable wire [BLL-M-35267-(5828.4)] N84-15564
Mechanical property characterization of F-100/934 graphite-epoxy composite material N84-16031
QUANTILES
Experimental designs for quantal response models [AD-A133416] N84-15851
QUANTITATIVE ANALYSIS
Development of quantitative infrared analysis for monitoring water and emulsifying agents in fire-resistant microemulsion diesel fuels [AD-A133242] N84-15286
QUANTUM CHEMISTRY
Application of the density matrix multipole expansion to stark quantum beats from beam-foil-excited hydrogen atoms [AD-A133603] N84-15193
QUANTUM CHROMODYNAMICS
Monte Carlo simulation of high p/sub P jets N84-15915
Problems at the interface between perturbative and nonperturbative quantum chromodynamics [DE84-002375] N84-16018
QUANTUM ELECTRONICS
Theory of pulse propagation and coherence in free electron [AD-A133334] N84-15544
QUANTUM MECHANICS
Fourier optics for the Maxwell field: Formalism and applications [DE84-002845] N84-15383
QUANTUM NUMBERS
TOF for heavy stable particle identification N84-15936
QUARKS
Detecting heavy quark jets N84-15939
QUARTZ
Manufacturing technology for high quality swept-culture growth quartz [AD-A133500] N84-15998
QUASARS
Optical and X-ray selected samples of quasars: Evolution of the luminosity distributions N84-16090

R

RADAR ATTENUATION
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1 [AD-A133587] N84-15380
RADAR CLUTTER MAPS
10 cm radar ground clutter measurements taken from a coastal steamer radar on passage from Bergen to North Cape in May 1982 N84-15667
RADAR DATA
The development of a digital processing system for accurate range determinations --- for Teleoperator Maneuvering Systems N84-16046
RADAR DETECTION
Analysis of US Coast Guard HU-25A visual and radar detection performance [AD-A133380] N84-15138
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
The effect of turbulent atmosphere on backscattered waves N84-15664
Optimum and sub-optimum processors for multistatic radar systems N84-15885
RADAR GEOLOGY
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields --- California and Pennsylvania [E84-10057] N84-15628
RADAR IMAGERY
A computer model for an imaging coherent laser radar [FOA-C-30341-E] N84-15388
Analysis of data acquired by synthetic aperture radar over Dade County, Florida, and Acadia Parish, Louisiana [E84-10067] N84-15636
Remote sensing with spaceborne synthetic aperture imaging radars: A review N84-15648
Ocean wave imaging by SAR N84-15649
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15651
RADAR MEASUREMENT
Ionospheric factors affecting the performance of HF sky-wave sea-state radars N84-15656
The Canadian programme of experimental measurement of sea-state characteristics by sky-wave radar N84-15657
F-region variability and HF-propagation N84-15658
Automatic electron density profiles from digital ionograms N84-15659
Extraterrestrial radio noise and its effect on radar performance N84-15662
RADAR RANGE
A FMCW radar ranging device for the teleoperator maneuvering system N84-16045
RADAR RECEIVERS
Laser radar analyses [AD-A133295] N84-15540
Optimum and sub-optimum processors for multistatic radar systems N84-15885
A radar signal processor implemented with surface acoustic waves devices N84-15889
RADAR RECEPTION
Extraterrestrial radio noise and its effect on radar performance N84-15662
RADAR RESOLUTION
Propagation effects in satellite-borne synthetic aperture radars N84-15650
RADAR SCATTERING
A review of propagation and scattering factors in remote-sensing and ship-tracking by HF radar N84-15655
RADAR TARGETS
The effect of turbulent atmosphere on backscattered waves N84-15664
RADAR TRACKING
A review of propagation and scattering factors in remote-sensing and ship-tracking by HF radar N84-15655
A long range propagation experiment to investigate the incidence of anomalous propagation in the north Atlantic N84-15669
RADAR TRANSMISSION
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1 [AD-A133587] N84-15380
Extraterrestrial radio noise and its effect on radar performance N84-15662
A FMCW radar ranging device for the teleoperator maneuvering system N84-16045
RADIAL DISTRIBUTION
Radial structure of curvature-driven instabilities in hot-electron plasma [DE84-002256] N84-15986
RADIANCE
Thematic mapper radiometric variability on ostensibly uniform agricultural scenes [E84-10035] N84-15626
Techniques for measuring radiance in the air and sea N84-15672
Optical multiple sample vacuum integrating sphere [NASA-CASE-GSC-12849-1] N84-15960
RADIANT FLUX DENSITY
Triggering at high luminosity: Fake triggers from pile-up N84-15932
RADIATION ABSORPTION
Effects of long-term low-level radiofrequency radiation exposure on rats. Volume 1: Design, facilities, and procedures [AD-A134079] N84-15756
RADIATION COUNTERS
Major detectors in elementary particle physics [LBL-91] N84-15910
Breakdown processes in wire chambers, prevention and rate capability N84-15923
The concept of a solid state direct chamber N84-15924
RADIATION DAMAGE
Evaluation of radiation damage to Metal-Oxide-Semiconductor (MOS) devices [AD-A133593] N84-16002
RADIATION DETECTORS
Proceedings of the 1983 DPF Workshop on Collider Detectors: Present Capacities and Future Possibilities [LBL-15973] N84-15911
Cross section estimates for multi-TeV physics N84-15914
Searching for limitations in capability due to high average rates N84-15919
Detectors at 20 TeV and detector considerations for a high luminosity hadron-hadron machine N84-15920

Large area non-crystalline semiconductor detectors N84-15925
Detecting heavy quark jets N84-15939
Angular coverage of detectors N84-15940

RADIATION DISTRIBUTION
Aperture efficiency considerations in the convolution synthesis of symmetrical hexagonal arrays
[AD-A133367] N84-15369

RADIATION DOSAGE
Summary of annual environmental reports for CY 1981: Department of Energy nuclear sites
[DOE/EP-0038/1] N84-15692
Effects of long-term low-level radiofrequency radiation exposure on rats. Volume 1: Design, facilities, and procedures
[AD-A134079] N84-15756
Dose conversion factors for inhaled radionuclides
[FOA-C-40184-A3] N84-15786

RADIATION EFFECTS
Effects of long-term low-level radiofrequency radiation exposure on rats. Volume 1: Design, facilities, and procedures
[AD-A134079] N84-15756
Duration of memory loss due to electron beam exposure
[AD-A132941] N84-15760
Lethal, potentially lethal lesion model
[DE84-001325] N84-15762
Radiation effects in the Joint European Torus Experiment: Guidelines for preliminary design
[R857/2] N84-15971
Evaluation of radiation damage to Metal-Oxide-Semiconductor (MOS) devices
[AD-A133593] N84-16002

RADIATION HARDENING
Thin N-I-P radiation resistant solar cells
[NASA-CR-168264] N84-15682
Evaluation of radiation damage to Metal-Oxide-Semiconductor (MOS) devices
[AD-A133593] N84-16002

RADIATION SOURCES
A review of source location/assessment techniques --- aeroacoustics N84-15029

RADIATIVE TRANSPORT
Problems in astrophysical radiation hydrodynamics
[DE84-000185] N84-16102

RADIATIVE HEAT TRANSFER
Loads and aeroelasticity division research and technology accomplishments for FY 1982 and plans for FY 1983
[NASA-TM-84594] N84-15120
Thermal analysis research applicable to space station technology needs
[NASA-TM-84658] N84-15426
Thermal and electrical interaction of tantalum with a low temperature chemically active plasma flow
[NASA-TM-77374] N84-15980

RADIATIVE TRANSFER
Application of two-dimensional discrete-ordinates methods to multiple scattering of laser radiation
[AD-A133258] N84-15539
In-flight absolute radiometric calibration of the thematic mapper
[E84-10064] N84-15633
Radiative-dynamic properties of Arctic stratus clouds and their possible modification by aerosol particles
[DFVLR-FB-83-23] N84-15740

RADIO ASTRONOMY
Very Large Array observations of solar active regions. 4: Structure and evolution of radio bursts from 20 cm loops
[AD-A133907] N84-16109

RADIO COMMUNICATION
Activities report in communications research performed in cooperation with Higher Institute for Posts and Telegraph (ISPT) N84-15384
Broadband base isolated asymmetrically fed VHF antenna N84-15393

RADIO EMISSION
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15661
Characteristics of RF lightning emission at 2 GHz and 250 MHz N84-16039

RADIO FREQUENCIES
Effects of long-term low-level radiofrequency radiation exposure on rats. Volume 1: Design, facilities, and procedures
[AD-A134079] N84-15756

RADIO FREQUENCY DISCHARGE
Characteristics of RF lightning emission at 2 GHz and 250 MHz N84-16039

RADIO GALAXIES
Optical flux and polarization spectra compared with radio maps of radio galaxies N84-16093

RADIO OBSERVATION
Aperture synthesis observations of star forming regions: Compact H2 regions and masers N84-16092

RADIO RECEPTION
Adaptive signal detection for the optimal communications receiver
[AD-A133498] N84-15374

RADIO SOURCES (ASTRONOMY)
Extraterrestrial radio noise and its effect on radar performance N84-15662
Optical flux and polarization spectra compared with radio maps of radio galaxies N84-16093

RADIO TRANSMISSION
Propagation Factors Affecting Remote Sensing by Radio Waves
[AGARD-CP-345] N84-15646
Determination of propagation limitations at HF by real-time update of a computer model from oblique sounder data N84-15660
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15661

RADIO WAVES
Propagation Factors Affecting Remote Sensing by Radio Waves
[AGARD-CP-345] N84-15646
Extraterrestrial radio noise and its effect on radar performance N84-15662

RADIOACTIVE DECAY
Detecting heavy quark jets N84-15939

RADIOACTIVE ISOTOPES
Status of research in progress at the Inhalation Toxicology Research Institute
[DE83-012610] N84-15694
Dose conversion factors for inhaled radionuclides
[FOA-C-40184-A3] N84-15786

RADIOACTIVE MATERIALS
Laboratory robotics at the Savannah River Laboratory
[DE84-001760] N84-15810

RADIOGRAPHY
Low X-ray absorption aneurism clips
[NASA-CASE-LAR-12650-2] N84-15764

RADIOMETERS
Techniques for measuring radiance in the air and sea N84-15672

RADIOMETRIC CORRECTION
Support for the Naval Research Laboratory Environmental Passive Microwave Remote Sensing Program
[AD-A133330] N84-15526

RADIOMETRIC RESOLUTION
Thematic mapper radiomtric variability on ostensibly uniform agricultural scenes
[E84-10035] N84-15626

RAIN
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1
[AD-A133587] N84-15380
Statistic prediction techniques of rain attenuation starting from pluviometric statistics --- microwave attenuation
[FUB-51-1982] N84-15387
Possible tidal modulation of the Indian monsoon onset N84-15721

RAMAN SPECTRA
Design and initial operational characteristics of a shock tube-Raman scattering calibration system
[AD-A133251] N84-15525
Raman measurements of the mobile cation vibrations in Na, K, Ag and Li (ALPHA)'-alumina
[DE83-015697] N84-16005

RAMAN SPECTROSCOPY
The CARS spectroscopy in a supersonic jet N84-15216

RANDOM NOISE
Digital communication in the presence of impulsive noise N84-15392
Application of the Gibbs distribution to image segmentation
[AD-A133406] N84-15850

RANDOM VARIABLES
On the fitting of Pearson curves to sums of independent random variables
[AD-A133153] N84-15844
A note on the analysis of random balance designs
[AD-A133287] N84-15848

RANGEFINDING
The development of a digital processing system for accurate range determinations --- for Teleoperator Maneuvering Systems N84-16046

RANGELANDS
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data
[E84-10068] N84-15637

RATES (PER TIME)
Thermal electron heating rate: A derivation
[NASA-TM-85124] N84-15941

RATINGS
Differentiated ratings of perceived exertion and selected physiological responses during prolonged upper and lower body exercise
[AD-A134086] N84-15769
Performance appraisal revisited
[AD-A132841] N84-16059

RATIOS
The polarization ratio of crystal monochromators
[AD-A133181] N84-15524
A numerical investigation of the multiple vortex phenomenon: Vortex number and structure as a function of swirl ratio N84-16049

RATS
Effects of long-term low-level radiofrequency radiation exposure on rats. Volume 1: Design, facilities, and procedures
[AD-A134079] N84-15756

REACTION KINETICS
Chemical kinetics modeling of engine knock: Preliminary results
[DE84-001236] N84-15226
Potentiostatic investigation of the kinetics of the breakdown of the passivity of aluminium in aqueous medium
[BLL-OA-TRANS-3066-(6196.3)] N84-15238
Precipitation of metals from solutions by baser metals
[CSIR-1712] N84-15242
LARC: Computer codes for Lagrangian analysis of stress-guage data to obtain decomposition rates through correlation to thermodynamic variables
[DE84-002404] N84-15292
Kinematics of the structure and morphology during surface reactions between transition metals and molecular hydrogen N84-15317
Use of scanning electron microscopy in studying surface reactions of metals with hydrogen N84-15318
Optical diagnostics for condensed-phase shock-compressed molecular systems
[DE84-001172] N84-15510
Electron-electron interactions and broken symmetry in one dimension
[DE84-001704] N84-16014
Atomic oxygen effects on materials N84-16036

REACTION TIME
Rapid solidification processing and powder metallurgy of Al alloys
[AD-A133873] N84-15250

REACTOR CORES
Thermohydraulics of LMFBR core catchers --- liquid metal fast breeder reactors (LMFBR) N84-15500

REACTOR SAFETY
Studies on sodium boiling phenomena in out of pile rod bundles for various accidental situations in Liquid Metal Fast Breeder Reactors (LMFBR) experiments and interpretations N84-15493
Temperature distributions, boiling and dry-out behind local blockages --- liquid metal fast breeder reactors (LMFBR) N84-15495
Sodium boiling experiments in bundle geometries under fast transient and steady state conditions --- fast breeder reactor safety analysis N84-15496
Thermohydraulics of LMFBR core catchers --- liquid metal fast breeder reactors (LMFBR) N84-15500

REACTOR TECHNOLOGY
The design of modern Low Pressure (LP) steam turbines N84-15473

READING
A comparison of map learning methods: Map study, simulated travel and mixed
[AD-A133544] N84-15794

REAL TIME OPERATION
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371
Automatic electron density profiles from digital ionograms N84-15659
Determination of propagation limitations at HF by real-time update of a computer model from oblique sounder data N84-15660
The debugging of real time multiprocessor systems: An integrated solution proposal
[CISE-2067] N84-15837

RECEIVERS
Analysis of short pulse laser altimetry data obtained over horizontal path
[NASA-CR-170612] N84-15535

RECOVERY
Rate of initial recovery and subsequent radar monitoring performance following a simulated emergency involving startle
[AD-A133602] N84-15795

RECOVERY PARACHUTES
New, high performance rotating parachute — reentry vehicle recovery
[DE84-002382] N84-15129
RECYCLING
North Carolina used-motor-oil re-refining program: Economics and logistics and operating results
[DE84-001448] N84-15277
REDOX CELLS
Electrochemical studies of redox systems for energy storage
[NASA-CR-174503] N84-15681
REDUCED GRAVITY
Liquid management in low gravity using baffled rotating containers
[NASA-TP-2263] N84-15427
REDUCTION (CHEMISTRY)
Corrosion research N84-15191
REDUNDANCY
Connecting aircraft and external loads N84-15046
REFERENCE ATMOSPHERES
Taquac, Guam Island. Range reference atmosphere 0-30 km altitude
[AD-A133618] N84-15736
REFLECTANCE
Optical properties of natural minerals and other materials in the 350-50000 cM-1 spectral region
[AD-A133530] N84-15965
Reflectance measurements, part 2 N84-16028
REFLECTION
Multiple scattering from a random and inhomogeneous slab N84-15624
Dip-moveout by Fourier transform N84-15699
REFLECTOMETERS
Reflectance measurements, part 2 N84-16028
REFLECTORS
A low loss quasioptical cavity for a two-stage Free Electron Laser (FEL)
[AD-A133321] N84-15541
REFRACTED WAVES
Seismic properties of the crust and uppermost mantle of North America
[NASA-CR-175134] N84-15708
REFRACTIVITY
High precision material study at near millimeter wavelengths
[AD-A133575] N84-15966
REFRACTORY MATERIALS
Heat transfer retardation at elevated temperatures. Phase 1: Analysis of heat transfer retardation configurations and materials
[AD-A133509] N84-16017
REFRACTORY METALS
A melt for the electrolytic application of titanium plating
[BLL-OA-TRANS-3111-(6L96.3)] N84-15241
REFRIGERANTS
A helium-3 refrigerator employing capillary confinement of liquid cryogen N84-15353
REFRIGERATING
A general computer model for predicting the performance of gas sorption refrigerators N84-15349
LaNi5 hydride cryogenic refrigerator test results N84-15350
REFRIGERATING MACHINERY
Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space
[NASA-TM-85066] N84-15555
REFRIGERATORS
Refrigeration for Cryogenic Sensors
[NASA-CP-2287] N84-15327
US Navy program in small cryocoolers N84-15328
Japanese activities in refrigeration technology N84-15330
Spacecraft-borne long life cryogenic refrigeration: Status and trends N84-15331
Regeneration experiments below 10K in a regenerative-cycle cryocooler N84-15332
A cryocooler for applications requiring low magnetic and mechanical interference N84-15333
An approach to optimization of low-power Stirling cryocoolers N84-15334
Regeneration efficiency, shuttle heat loss and thermal conductivity in epoxy-composite annualr gap regenerators from 4K to 80K N84-15335
A 10 deg K triple-expansion Stirling-cycle cryocooler N84-15336
Compact Claude cycle refrigerator for laboratory use N84-15338
A small and light weight heat exchanger for on-board helium refrigerator N84-15339
Life test performance of a Philips rhombic-drive refrigerator with bellows seals N84-15341
Split-Stirling, linear-resonant, cryogenic refrigerators for detector cooling N84-15342
Computer program for analysis of split-Stirling-cycle cryogenic coolers N84-15344
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
Gifford-McMahon refrigerator with split cold head N84-15346
A helium-3 refrigerator employing capillary confinement of liquid cryogen N84-15353
Cascade Joule-Thomson refrigerators N84-15354
Suitability of commercially available laboratory cryogenic refrigerators to support shipboard electro-optical systems in the 10 - 77 Kelvin region N84-15355
Low cost microminiature refrigerators for large unit volume applications N84-15356
4.0 K cryocooler project
[DE84-000332] N84-15358
REGENERATIVE COOLING
Regeneration efficiency, shuttle heat loss and thermal conductivity in epoxy-composite annualr gap regenerators from 4K to 80K N84-15335
An application of gap regenerator/expander precooled by two stage G-M refrigerator N84-15337
REGENERATORS
An application of gap regenerator/expander precooled by two stage G-M refrigerator N84-15337
The theory of an active magnetic regenerative refrigerator N84-15351
4.0 K cryocooler project
[DE84-000332] N84-15358
REGRESSION ANALYSIS
A law of the iterated logarithm for non-parametric regression function estimators
[AD-A133260] N84-15847
On jackknifing kernel regression function estimators
[AD-A133236] N84-15867
On the maximum likelihood estimate for logistic errors-in-variables regression models
[AD-A133253] N84-15868
Fitting a multiple regression function
[AD-A133482] N84-15874
REGULATIONS
Aircraft operations from airfields with special unconventional characteristics N84-15085
REINFORCEMENT (STRUCTURES)
A three-dimensional photoelastic investigation of stresses and cracks formed in concrete around deformed reinforcing bars N84-15621
REINFORCING FIBERS
Production and characterization of beta-silicon carbide and alpha-silicon nitride whiskers for ceramic matrix composites
[LA-9650-MS] N84-15197
RELATIVISTIC EFFECTS
Future search for grand unified theory magnetic monopoles
[DE83-009451] N84-16015
RELATIVISTIC ELECTRON BEAMS
Beam propagation experimental study
[AD-A133310] N84-15946
Finite geometry effects on the stability of a charged beam propagating through a relativistic annular electron beam
[AD-A133338] N84-15948
RELAXATION (MECHANICS)
Subpicosecond-relaxation studies using tunable-laser-induced-grating techniques N84-15531
RELAXATION METHOD (MATHEMATICS)
A local-relaxation method for solving convection-diffusion equations
[NLR-MP-82030-U] N84-15862
RELIABILITY
Design, development and flight test of a demonstration advanced avionics system N84-15067
Research in some applied, and the modelling aspects of, reliability theory
[AD-A133424] N84-15567
RELIABILITY ANALYSIS
A survey of network reliability
[AD-A133545] N84-15835
Statistical analysis of a debugging model N84-16048
RELIABILITY ENGINEERING
Simulation requirements to support the development of a fault tolerant avionic system N84-15072
REMOTE CONTROL
IRIG standard for distributing interrange vector acquisition data
[AD-A133617] N84-15170
Robot manipulator control
[AD-A129365] N84-15800
The Stanford cart and the CMU Rover
[NASA-CR-174502] N84-15803
REMOTE HANDLING
Robot manipulator control
[AD-A129365] N84-15800
REMOTE SENSING
Landsat 4 TM-data: Examples of resolution capacity
[FOA-C-30329-E1] N84-15644
Propagation Factors Affecting Remote Sensing by Radio Waves
[AGARD-CP-345] N84-15646
The European Space Agency's Earth observation satellite programmes N84-15647
Remote sensing with spaceborne synthetic aperture imaging radars: A review N84-15648
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15651
A review of propagation and scattering factors in remote-sensing and ship-tracking by HF radar N84-15655
Lidar remote sensing of internal waves and optical properties N84-15670
Passive remote sensing of ocean optical propagation parameters N84-15673
Remote sensing of atmospheric pressure and sea state from satellites using short-pulse multicolor laser altimeters N84-15674
REMOTE SENSORS
Spectral characterization of the LANDSAT thematic mapper sensors
[E84-10065] N84-15634
Multispectral Data Processing System (MDPS)
[AD-A133426] N84-15816
REMOTELY PILOTED VEHICLES
Design considerations for remotely piloted, high-altitude airplanes powered by microwave energy
[NASA-TM-85730] N84-15145
REPEATERS
The meteorological data distribution mission on board SIRIO satellite N84-15891
REPLACING
Mechanical fastener
[NASA-CASE-LAR-12738-2] N84-15180
REPLENISHMENT
Hot melt recharge system — space maintenance
[NASA-CASE-LAR-12881-2] N84-15271
REPORTS
Incident reporting: Its role in aviation safety and the acquisition of human error data N84-15081
REQUIREMENTS
A guideline for the planning and system requirement determination of a computer based educational system
[AD-A133529] N84-15829
RESCUE OPERATIONS
Analysis of US Coast Guard HU-25A visual and radar detection performance
[AD-A133380] N84-15138
RESEARCH
Loads and aeroelasticity division research and technology accomplishments for FY 1982 and plans for FY 1983
[NASA-TM-84594] N84-15120
Research reports: 1983 NASA/ASEE Summer Faculty Fellowship Program
[NASA-CR-170942] N84-16022
RESEARCH AND DEVELOPMENT
Activities report in communications research performed in cooperation with Higher Institute for Posts and Telegraph (ISPT) N84-15384
RESEARCH MANAGEMENT
European Scientific Notes. Volume 37, number 9
[AD-A133558] N84-16079
RESIDENTIAL AREAS
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data
[E84-10068] N84-15637
RESIDUAL STRESS
Welding deformations and residual stresses due to circumferential welding of cylindrical shells and hemispherical end plates
[BLL-DRIC-T-6968-(3623.66)] N84-15549
RESIDUES
Elastomeric impression materials and cleaning systems for residue removal
[RFP-3442] N84-15296
RESONANCE
Simultaneous electron capture and excitation in ion-atom collisions
[DE83-005799] N84-15907
RESONANT VIBRATION
Split-Stirling, linear-resonant, cryogenic refrigerators for detector cooling N84-15342
RESOURCE ALLOCATION
Advanced teleprocessing systems
[AD-A133525] N84-15375
RESOURCES MANAGEMENT
Appraisal of scientific resources for emergency management
[AD-A133285] N84-16062
RESPIRATION
Status of research in progress at the Inhalation Toxicology Research Institute
[DE83-012610] N84-15694

Dose conversion factors for inhaled radionuclides
[FOA-C-40184-A3] N84-15786
RESPONSES
Status of research in progress at the Inhalation Toxicology Research Institute
[DE83-012610] N84-15694
Neuronal adaptive mechanisms underlying intelligent information processing
[AD-A133694] N84-15776
Experimental designs for quantal response models
[AD-A133416] N84-15851
RETINAL IMAGES
Spatiotemporal characteristics of visual localization
[AD-A133952] N84-15770
Spatial localization in strabismic observers
[AD-A132748] N84-15784
RETROFITTING
Split-Stirling-cycle displacer linear-electric drive N84-15343
NAHBE (Naval Academy Heat Balanced Engine) m151 retrofit evaluation
[AD-A133475] N84-15559
REVERSE FIELD PINCH
Sustained self-reversal in the reversed field pinch
[DE84-001559] N84-15990
REVISIONS
Preliminary designs for modifications to the X-ray source and beam monitor of the Marshall Space Flight Center's X-ray Calibration Facility N84-16032
REYNOLDS NUMBER
Computational and experimental study of trailing vortices N84-15103
Design, construction, and use of a high-resolution, two-component LDA N84-15419
REYNOLDS STRESS
Design, construction, and use of a high-resolution, two-component LDA N84-15419
RIBBONS
Arc spray fabrication of metal matrix composite monotape — high temperature fiber-reinforced superalloy composites
[NASA-CASE-LEW-13828-1] N84-15203
RIBS (SUPPORTS)
A three-dimensional photoelastic investigation of stresses and cracks formed in concrete around deformed reinforcing bars N84-15621
RIPPLES
The effect of superposing ripple loading of maneuver load cycles
[AD-A132653] N84-15148
RISK
On Bayes and empirical bayes rules for selecting good populations
[AD-A133336] N84-15869
RIVERS
Spatial reasoning to determine stream network from LANDSAT imagery
[E84-10063] N84-15632
Use of LANDSAT MSS (multispectral scanner) digital data in water quality mapping of the Neuse River estuary, North Carolina
[PB83-256750] N84-15645
ROADS
Microwave methods and apparatus for paving and paving maintenance
[DE84-016306] N84-15359
ROBOTICS
Automatic inspection for printed wiring
[AD-A133328] N84-15566
The Stanford cart and the CMU Rover
[NASA-CR-174502] N84-15803
The human side of robotics: Results from a prototype study on how workers react to a robot
[AD-A133438] N84-15805
Implementation of automatic focusing algorithms for a computer vision system with camera control
[AD-A133492] N84-15807
Laboratory robotics at the Savannah River Laboratory
[DE84-001760] N84-15810
Sensor control of robot arc welding N84-16047
European Scientific Notes. Volume 37, number 9
[AD-A133558] N84-16079
ROBOTS
Robotics-related technology in the nuclear industry
[DE83-017131] N84-15799
Robot manipulator control
[AD-A129365] N84-15800
A distributed control system for the CMU Rover
[AD-A133201] N84-15802
The human side of robotics: Results from a prototype study on how workers react to a robot
[AD-A133438] N84-15805
Laboratory robotics at the Savannah River Laboratory
[DE84-001760] N84-15810
ROCK MECHANICS
Microcrack damage model of brittle rock
[DE84-002088] N84-15717
ROCKET ENGINES
Journal of Engineering Thermophysics (selected articles)
[AD-A133167] N84-15184
ROCKET FIRING
Optimal low thrust, three burn orbit transfers with large plane changes N84-15166
ROCKET THRUST
Dynamic certification of a thrust-measuring system for large solid rocket motors N84-15603
ROCKS
Magnetic anomalies in east Pacific using MAGSAT data
[E84-10060] N84-15630
Wave propagation in porous rock and models for crustal structure N84-15698
ROTARY WING AIRCRAFT
Rotorcraft icing technology: An update N84-15084
ROTARY WINGS
Rotorcraft icing technology: An update N84-15084
A study of helicopter rotor aerodynamics in ground-effect at low speeds N84-15106
ROTATING CYLINDERS
An experimental investigation of the boundary layer structures in a partially-filled horizontal and rapidly-rotating cylinder N84-15414
Liquid management in low gravity using baffled rotating containers
[NASA-TP-2263] N84-15427
ROTATING GENERATORS
Advanced high-power generator for airborne applications
[AD-A133290] N84-15398
ROTATING STALLS
Flow mechanism and experimental investigation of a rotating stall in transonic compressors
[NASA-TM-77373] N84-15122
ROTATION
The structure of turbulent entraining flow in an annulus with a rotating screen N84-15416
All-fiber gyroscope with optical-Kerr-effect compensation N84-15518
Numerical simulations of convectively excited gravity waves
[DE84-001867] N84-15718
ROTOCHUTES
New, high performance rotating parachute --- reentry vehicle recovery
[DE84-002382] N84-15129
ROTOR AERODYNAMICS
Aerodynamics and steam wetness fraction of a multistage turbine. Comparison of prediction with experimental data N84-15475
A review of current research activity on the aerodynamics of axial flow turbines N84-15480
Experimental determination of gap flow-conditioned forces at turbine stages and their effect on the running stability of simple rotors
[NASA-TM-77293] N84-15553
Linear and nonlinear aspects of rotordynamics N84-16034
ROTOR BLADES (TURBOMACHINERY)
A method of calculating fully three dimensional inviscid flow through any type of turbomachine blade row N84-15479
ROTOR SPEED
Recent advances in variable speed electrical generator systems for large wind turbines
[DE84-001833] N84-15404
RUBY LASERS
Beam processing for high-efficiency Si solar cells
[DE84-002059] N84-15690
RUNWAY CONDITIONS
Results from wind tunnel and artificial rainfall tests of the modified scan sensor
[AD-A133238] N84-15162
RUNWAYS
Aircraft operations from airfields with special unconventional characteristics N84-15085
RUTHENIUM COMPOUNDS
Inorganic chemistry N84-15192
RUTILE
Trichite growth during oxidation of titanium and TA6V4 alloy by water vapor at high temperatures
[NASA-TM-76974] N84-15248

S

SABOT PROJECTILES
Capabilities of the NRCC/NAE flight impact simulator facility
[AD-A130849] N84-15136
SAFETY
Aerodynamics, aeroelasticity, and stability of hang gliders N84-15134
SALINITY
On the functional dependence of the freezing point of soils on the composition of water soluble salts in an interstitial solution
[NRC/CNR-TT-2070] N84-15707
SAMPLERS
Optical multiple sample vacuum integrating sphere
[NASA-CASE-GSC-12849-1] N84-15960
SAMPLING
Complete sample analysis by gas chromatography
[BLL-T6213/BG/LRS/LRST671/83] N84-15212
Review of properties of various types of calorimeters: High luminosity and high energy N84-15917
Jet-impact nebulization for sample introduction in inductively coupled plasma spectrometry
[AD-A133152] N84-15982
Atomic oxygen effects on materials N84-16036
SATELLITE ANTENNAS
Earth coverage corrugated horns (44.5 GHz and 20.7 GHz)
[AD-A133241] N84-15366
The meteorological data distribution mission on board SIRIO satellite N84-15891
SATELLITE INSTRUMENTS
Spectral characterization of the LANDSAT thematic mapper sensors
[E84-10065] N84-15634
SATELLITE OBSERVATION
Ionospheric factors affecting the performance of HF sky-wave sea-state radars N84-15656
SATELLITE ROTATION
Capture-ejector satellites
[NASA-TM-85686] N84-15179
SATELLITE TRANSMISSION
The satellite applications of amplitude companded single sideband modulation N84-15391
SATELLITE-BORNE INSTRUMENTS
NASA needs and trends in cryogenic cooling N84-15329
SATELLITE-BORNE RADAR
Propagation effects in satellite-borne synthetic aperture radars N84-15650
SATURN RINGS
Voyager observations of Saturn's rings. 1: The eccentric rings at 1.29, 1.45, 1.95 and 227 Rs N84-16087
SCALE MODELS
The salt-gradient solar pond
[AD-A126702] N84-15683
Scaling wind characteristics for designing small and large wind turbines
[DE83-014501] N84-15728
SCALING LAWS
Copper vapor laser scale demonstration
[AD-A133327] N84-15543
SCATTERING
Multiple scattering from a random and inhomogeneous slab N84-15624
SCATTERING CROSS SECTIONS
Design and initial operational characteristics of a shock tube-Raman scattering calibration system
[AD-A133251] N84-15525
Comment on the extinct paradox
[NASA-TM-85113] N84-15958
Mie code AGAUS 82
[AD-A133489] N84-15964
SCHEDULING
Exploiting temporal knowledge to organize constraints
[AD-A133417] N84-15838
ISIS: A constraint-directed reasoning approach to job shop scheduling
[AD-A133296] N84-16083
SCINTILLATION
Propagation effects in satellite-borne synthetic aperture radars N84-15650
Calorimetry at L = 10/sup 33 N84-15931
SCINTILLATION COUNTERS
The design and expected performance of a fast scintillator hadron calorimeter N84-15926
Scintillation chamber operation of calorimters for colliding beam detectors N84-15927
High energy electromagnetic shower position measurement by a fine grained scintillation hodoscope N84-15928
Scintillators and waveshifters for fast scintillator-WSB calorimetry N84-15929
A measurement of the response of an SCG1-C scintillation glass shower detector to 2-17.5 GeV positrons N84-15930
SCORING
Comparison of IRT observed-score and true-score equatings
[AD-A133871] N84-15791

SCORPIUS CONSTELLATION
Periodic spectral variation in Cygnus X-2 and Scorpius X-1 N84-16088
SEA ICE
Geophysical data from drifting ice stations FRAM 4 and TRISTEN
[AD-A133370] N84-15640
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15651
SEA STATES
A review of propagation and scattering factors in remote-sensing and ship-tracking by HF radar N84-15655
Ionospheric factors affecting the performance of HF sky-wave sea-state radars N84-15656
The Canadian programme of experimental measurement of sea-state characteristics by sky-wave radar N84-15657
Automatic electron density profiles from digital ionograms N84-15659
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
Remote sensing of atmospheric pressure and sea state from satellites using short-pulse multicolor laser altimeters N84-15674
SEA WATER
In situ characterization of seawater using a computerized suite of optical instruments N84-15675
SEALS (STOPPERS)
An evaluation of Techroll seal flexible joint material N84-16037
SEARCH RADAR
Considerations for choosing microwave transistors in high power shipboard search radars
[AD-A133279] N84-15367
SEARCHING
A review of underwater acoustic systems and methods for locating objects lost at sea
[NASA-TM-85727] N84-15898
SEAS
Climate-chemistry connection
[DE84-001950] N84-15739
SEDIMENTS
Uranium anomalies in Wyoming and parts of adjacent states. National Uranium Resource Evaluation
[DE83-005353] N84-15638
Marine environmental acoustics
[AD-A133245] N84-15902
Determination of particle-size distribution by measuring the transmission of an aerosol in sedimentation
[AD-A133288] N84-15962
SEGMENTS
Application of the Gibbs distribution to image segmentation
[AD-A133406] N84-15850
SEISMIC WAVES
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields --- California and Pennsylvania
[E84-10057] N84-15628
Seismic properties of the crust and uppermost mantle of North America
[NASA-CR-175134] N84-15708
The Norwegian Seismic Array (NORSAR). Phase 3
[AD-A134038] N84-15713
Surface wave path corrections, deterministic discrimination and body wave attenuation
[AD-A133574] N84-15714
State-of-the-Art for assessing earthquake hazards in the United States. Report 20: The contribution of directivity focusing to earthquake intensities
[AD-A132893] N84-15716
SEISMOGRAPHS
Dip-moveout by Fourier transform N84-15699
Constraints on the Earth's anelastic and aspherical structure from antipodal surface waves N84-15700
SEISMOLOGY
Synthesis of regional crust and upper-mantle structure from seismic and gravity data
[E84-10061] N84-15631
Wave propagation in porous rock and models for crustal structure N84-15696
Constraints on the Earth's anelastic and aspherical structure from antipodal surface waves N84-15700
Effective use of earthquake data
[AD-A134077] N84-15712
The Norwegian Seismic Array (NORSAR). Phase 3
[AD-A134038] N84-15713
Surface wave path corrections, deterministic discrimination and body wave attenuation
[AD-A133574] N84-15714
SELECTION
An estimation problem relating to subset selection for normal populations
[AD-A133387] N84-15870
SEMANTICS
Analyzing the roles of descriptions and actions in open systems
[AD-A133614] N84-15878
SEMICONDUCTORS (MATERIALS)
Etching of defects on crystal surfaces N84-15300
Surface photoluminescence and it application N84-15304
Large area non-crystalline semiconductor detectors N84-15925
Study of phase diagrams of ternary semiconductors
[AD-A133556] N84-16000
Organometallic epitaxy for GaAs/AlGaAs microwave transistors and integrated circuits
[AD-A133569] N84-16001
InAsSb strained-layer superlattices for long wavelength detector applications
[DE84-001055] N84-16004
An In0 2Ga0 8As/GaAs, modulation-doped, strained-layer superlattice field-effect transistor
[DE84-000136] N84-16006
Project objectives and progress at the Research Laboratory of Electronics
[RLE-125] N84-16016
Compositional segregation in unidirectionally solidified solid solution crystals N84-16055
SENSITIVITY
Electrofluidic angular rate sensor for ejection seat thrust vector control
[AD-A133233] N84-15137
Surface analysis by particle beams N84-15301
Evaluation of type 2 fast packs for electrostatic discharge properties
[AD-A133158] N84-15557
The causation and variability of the northern winter quasi-stationary planetary waves N84-15705
Perception of higher derivatives of visual motion
[AD-A133908] N84-15773
Basic vision events
[AD-A132746] N84-15782
Synthesis of insensitive controllers in linear quadratic control problems
[REPT-605] N84-15841
SENSORIMOTOR PERFORMANCE
Rate of initial recovery and subsequent radar monitoring performance following a simulated emergency involving startle
[AD-A133602] N84-15795
SEPARATED FLOW
Flow improvements in the circuit of the Langley 4- by 7-meter tunnel
[NASA-TM-85662] N84-15117
Numerical simulation of separated flows N84-15413
SEPARATION
Analytical chemistry N84-15189
Surface segration and diffusion investigations by means of AES N84-15319
Compositional segregation in unidirectionally solidified solid solution crystals N84-16055
Evaluation of the separability of monodisperse polystyrene latex microspheres in a continuous flow electrophoresis system N84-16057
SERIES (MATHEMATICS)
An algorithm for detecting a change in stochastic process
[AD-A134104] N84-15842
SERIES EXPANSION
Asymptotic theory of an unseparated supersonic turbulent boundary layer at a compression corner N84-15112
Nonlinear acoustics instabilities in combustion chambers N84-15230
Computation of steady internal flows using integral representation methods with finite series expansions N84-15418
The generalized Euler-Mascheroni constants
[NASA-TP-2264] N84-15880
The generalized Euler-Mascheroni constants N84-16024
SERVICE LIFE
Vernier Rocket Motor Mk 84 Mod 0 quality evaluation
[AD-A133301] N84-15185
Battery lifetime prediction by pattern recognition application to lead-acid battery life-cycling test data
[AD-A133281] N84-15397
SERVOCONTROL
The MIRAGE 2000: Fly by wire control and safety N84-15093
Maser cavity servo-tuning system
[NASA-CASE-NPO-15890-1] N84-15536
SET THEORY
The travelling salesman problem in graphs with 3-edge cutsets
[AD-A133504] N84-15852
An estimation problem relating to subset selection for normal populations
[AD-A133387] N84-15870
SHAKERS
Multishaker modal testing
[NASA-CR-170952] N84-15521
SHAPES
Visual routines
[AD-A133634] N84-15792
A representation for shape based on peaks and ridges in the difference of low-pass transform
[AD-A133299] N84-15849
SHEAR FLOW
Generation of sound in turbulent shear flows N84-15031
The effect of flow oscillations on cavity drag, and a technique for their control N84-15109
Bifurcations in nonlinear problems of hydrodynamic instability of plane parallel shear flows N84-15411
Turbulent shear flows --- conferences
[VKI-LS-1983-03] N84-15448
Introduction to turbulent shear flows N84-15449
Eddy detection within turbulent shear flows N84-15453
The bursting phenomenon in bounded shear flows N84-15454
Thermal tides in the atmosphere of Venus N84-15702
SHEAR LAYERS
The effect of flow oscillations on cavity drag, and a technique for their control N84-15109
Three-dimensional turbulent boundary layers N84-15459
Three-dimensional turbulent boundary layers in turbomachines N84-15460
The effects of acoustic excitation on the mixing of two parallel laminar streams of fluid
[AD-A126788] N84-15502
SHEAR PROPERTIES
Nonlinear viscoelastic characterization of structural adhesives
[NASA-CR-172279] N84-15268
Results from a two-layer and a reduced gravity model of the Alboran Sea; and vertical shear from tops
[AD-A133753] N84-15752
SHEAR STRESS
Some notes on 3-dimensional turbulent boundary layer data and turbulence modeling
[NLR-MP-82007-U] N84-15513
SHEEP
Biological chemistry N84-15190
SHELLS (STRUCTURAL FORMS)
An integrated system for shells with discontinuities: Geometric modelling and finite element analysis N84-15576
SHIELDING
Fluid shielding of high-velocity jet noise
[NASA-TP-2259] N84-15894
SHIPS
Rubber-modified epoxy and glass laminates for application to naval ship structures
[AD-A133305] N84-15204
A review of propagation and scattering factors in remote-sensing and ship-tracking by HF radar N84-15655
Local area networks: Impact on shipboard applications N84-15888
SHOCK
Rate of initial recovery and subsequent radar monitoring performance following a simulated emergency involving startle
[AD-A133602] N84-15795
SHOCK FRONTS
Optical diagnostics for condensed-phase shock-compressed molecular systems
[DE84-001172] N84-15510
SHOCK LOADS
Report and recommendations for improving constitutive relations used in computer codes --- shock mechanics in solids
[AD-A133239] N84-15823
SHOCK TUBES
Design and initial operational characteristics of a shock tube-Raman scattering calibration system
[AD-A133251] N84-15525
SHOCK WAVES
Shock associated noise --- nozzles N84-15030
Fully-coupled analysis of jet mixing problems. Part 1. Shock-capturing model, SCIPVIS
[NASA-CR-3761] N84-15425
The relation between power and energy in the shock initiation of detonations. 1: Basic theoretical considerations and the effects of geometry
[AD-A133468] N84-15505

Numerical modeling and fast-solver calculation of approximately normal shocks
[NLR-MP-82026-U] N84-15856
Acoustic shocks in a variable area duct containing near sonic flows
[NASA-CR-172274] N84-15897
On the relationship between collisionless shock structure and energetic particle acceleration
[NASA-CR-175328] N84-15909

SHORT TAKEOFF AIRCRAFT
Aircraft operations from airfields with special unconventional characteristics N84-15085
Nonlinear transformat
[NASA-CR-166506] N84-15877

SIDELOBE REDUCTION
Video processor for air traffic control beacon system
[NASA-CASE-KSC-11155-1] N84-15395

SIGNAL ANALYSIS
Instrumentation and signal analysis — aeroacoustics N84-15032
Video processor for air traffic control beacon system
[NASA-CASE-KSC-11155-1] N84-15395
Input-output characterization of an ultrasonic testing system by digital signal analysis
[NASA-CR-3756] N84-15565

SIGNAL DETECTION
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1
[AD-A133587] N84-15380
Digital communication in the presence of impulsive noise N84-15392

SIGNAL DETECTORS
ECAJ (Electronic Counter Measure) signal discrimination and identification techniques
[AD-A133427] N84-15372

SIGNAL PROCESSING
Towards the functional partitioning of highly integrated, fault tolerant avionics signal processors N84-15047
Low rate transmission of video signals using adaptive delta modulation
[AD-A133145] N84-15363
Adaptive signal detection for the optimal communications receiver
[AD-A133498] N84-15374
Digital communication in the presence of impulsive noise N84-15392
Performance characteristics of passive coherence estimators
[AD-A133209] N84-15396
Time delay estimation using the adaptive delay element
[DE84-002042] N84-15403
Maximum entropy linear prediction method
[FUB-18-1982] N84-15857
Linear prediction methods — signal processing
[FUB-52-1982] N84-15858
Geometric methods for linear prediction — signal processing
[FUB-54-1982] N84-15859
Stationary stochastic processes — spectrum analysis
[ESA-TT-812] N84-15875
Optimum and sub-optimum processors for multistatic radar systems N84-15885
A radar signal processor implemented with surface acoustic waves devices N84-15889
The maximum entropy method and its application to clutter cancellation N84-15890
The development of a digital processing system for accurate range determinations — for Teleoperator Maneuvering Systems N84-16046

SIGNAL REFLECTION
An NMR study of solid hydrogen using packer solid echoes and rotating reference frame relaxation N84-15992

SIGNAL TO NOISE RATIOS
Adaptive arrays for multiple simultaneous desired signals
[AD-A133486] N84-15373
Performance characteristics of passive coherence estimators
[AD-A133209] N84-15396

SIGNAL TRANSMISSION
Multiple paths on the ocean surface N84-15666

SILANES
Synthesis of N-substituted silaneamines: Monomeric precursors of silicon carbide-nitride fibers N84-16033

SILICON
Thin N-I-P radiation resistant solar cells
[NASA-CR-168284] N84-15682
Beam processing for high-efficiency Si solar cells
[DE84-002059] N84-15690
Determination of ionization rates in the principal crystallographic directions in silicon
[AD-A133513] N84-15999

SILICON CARBIDES
Production and characterization of beta-silicon carbide and alpha-silicon nitride whiskers for ceramic matrix composites
[LA-9650-MS] N84-15197
Fabrication and properties of multilayer structures
[NASA-CR-174506] N84-15997
Synthesis of N-substituted silaneamines: Monomeric precursors of silicon carbide-nitride fibers N84-16033

SILICON NITRIDES
Production and characterization of beta-silicon carbide and alpha-silicon nitride whiskers for ceramic matrix composites
[LA-9650-MS] N84-15197
Synthesis of N-substituted silaneamines: Monomeric precursors of silicon carbide-nitride fibers N84-16033

SILOXANES
Ultrahigh molecular weight aromatic siloxane polymers N84-16042

SIMULATORS
Orbital maneuvering vehicle simulation system on-board processing logic N84-16052

SINGLE CRYSTALS
Low-cost single-crystal turbine blades, volume 1
[NASA-CR-168218] N84-15247
Electrical conductivities of polycrystalline and single-crystal Er2O3-stabilized hafnia
[DE83-017681] N84-15279
Surface photoluminescence and it application N84-15304
Surface segration and diffusion investigations by means of AES N84-15319
Structural properties of epitaxial single layer metals on (110) B.C.C. metal substrates N84-15326

SINGLE SIDEBAND TRANSMISSION
The satellite applications of amplitude companded single sideband modulation N84-15391

SINGLE-PHASE FLOW
Single phase sodium flow in complex and deformed generators N84-15489

SIRIO SATELLITE
The small transmitter receiver stations in the Sirio experiment — microwave transmission
[FUB-50-1982] N84-15386
The European Space Agency's Earth observation satellite programmes N84-15647
Rivista Tecnica Selenia, volume 8, number 3, 1983 N84-15887
The meteorological data distribution mission on board SIRIO satellite N84-15891

SITE SELECTION
Confidence region for the evaluation of HF DF single site location systems
[AD-A133208] N84-15140

SKEWNESS
Taquac, Guam Island. Range reference atmosphere 0-30 km altitude
[AD-A133618] N84-15736

SLABS
Combustion at the interface of an oxidizer-fuel slab system N84-15215
Multiple scattering from a random and inhomogeneous slab N84-15624
Analytical and numerical solution for a solidifying liquid alloy slab N84-16025

SLEEP DEPRIVATION
Sleep and wakefulness handbook for flight medical officers
[AGARD-AG-270(FR)] N84-15788

SNOW
Growth processes of snow
[AD-A133136] N84-15639

SNOW COVER
Snow thickness and brightness temperature on multi-year ice
[AD-A133940] N84-15747

SOCIOLOGY
Performance appraisal revisited
[AD-A132841] N84-16059

SODIUM CHLORIDES
Thermodynamics of aqueous sodium chloride to 823 K and 1 kbar
[DE84-001841] N84-16019

SODIUM COMPOUNDS
Catalysis of nitramine propellants by mmtal borohydrides
[AD-A133215] N84-15285

SOFTWARE ENGINEERING
Towards a modularity of software conceived for the requirement of the user N84-15040
CASCADE: A design environment for future avionic systems N84-15057
Sparse Matrix Software Catalog
[AD-A133559] N84-15830

SOIL MECHANICS
Development of generic mobility-terrain data bases: Investigation of critical soil parameters
[AD-A133595] N84-15715

SOIL SCIENCE
An interactive soils information system. Users manual
[AD-A133480] N84-16078

SOILS
On the functional dependence of the freezing point of soils on the composition of water soluble salts in an interstitial solution
[NRC/CNR-TT-2070] N84-15707
An interactive soils information system. Users manual
[AD-A133480] N84-16078

SOLAR ACTIVITY
Very Large Array observations of solar active regions. 4: Structure and evolution of radio bursts from 20 cm loops
[AD-A133907] N84-16109
The circularly polarized sun at 12.6 cm wavelength
[AD-A133668] N84-16110

SOLAR ARRAYS
Current collection from the space plasma through defects in high voltage solar array insulation N84-15970
Finite element analysis of a deployable space structure N84-16056

SOLAR CELLS
Thin N-I-P radiation resistant solar cells
[NASA-CR-168284] N84-15682
Beam processing for high-efficiency Si solar cells
[DE84-002059] N84-15690
Progress in polycrystalline thin-film solar cells
[DE83-012131] N84-15691
Current collection from the space plasma through defects in high voltage solar array insulation N84-15970

SOLAR COLLECTORS
Stirling engines with controlled evaporation of a two-phase two-component working fluid
[DE83-017284] N84-15560
Development of a consensus standard for determining thermal performance of high-concentration-ratio solar collectors
[DE83-005129] N84-15676
Direct steam generation in line-focus solar collectors
[DE83-006030] N84-15678
Line-focusing adjustable parabolic splar-concentrating collector
[DE84-001590] N84-15687
Determination of freeze protection heat loss from a parabolic trough solar system
[DE84-000005] N84-15689

SOLAR COSMIC RAYS
Turbulent heating in solar cosmic ray theory
[NASA-85074] N84-16108

SOLAR ENERGY
High-temperature molten salt thermal energy storage systems for solar applications
[NASA-CR-167916] N84-15679
Clear atmospheric effects on insolation illustrated by broad-band radiometer measurements N84-15701

SOLAR FLARES
Decimetric gyrosynchrotron emission during a solar flare
[NASA-TM-85123] N84-16107
Turbulent heating in solar cosmic ray theory
[NASA-85074] N84-16108

SOLAR HEATING
Evaluation of air-cooled central receivers
[DE83-005130] N84-15423
Stirling engines with controlled evaporation of a two-phase two-component working fluid
[DE83-017284] N84-15560

SOLAR INSTRUMENTS
Fine pointing control of the solar UV telescope on the sounding rocket S-520-5
[ISAS-608] N84-16094

SOLAR MESOSPHERE EXPLORER
JPL closeup
[NASA-CR-175324] N84-15168

SOLAR PONDS (HEAT STORAGE)
The salt-gradient solar pond
[AD-A126702] N84-15683

SOLAR RADIATION
Pacific Northwest solar radiation data
[DE84-002335] N84-15738

SOLAR RADIO BURSTS
Very Large Array observations of solar active regions. 4: Structure and evolution of radio bursts from 20 cm loops
[AD-A133907] N84-16109

SOLAR RADIO EMISSION
The circularly polarized sun at 12.6 cm wavelength
[AD-A133668] N84-16110

SOLAR WIND
On the relationship between collisionless shock structure and energetic particle acceleration
[NASA-CR-175328] N84-15909
The harmonic structure of PC 3-4 magnetic pulsations at geosynchronous orbit and its relation to the solar wind N84-16106
SOLENOIDS
Compact Claude cycle refrigerator for laboratory use N84-15338
SOLID ELECTROLYTES
Electrically controlled coloration of materials
[AD-A133420] N84-15223
SOLID PROPELLANT COMBUSTION
Catalysis of nitramine propellants by mmtal borohydrides
[AD-A133215] N84-15285
SOLID PROPELLANT ROCKET ENGINES
Vernier Rocket Motor Mk 84 Mod 0 quality evaluation
[AD-A133301] N84-15185
Dynamic certification of a thrust-measuring system for large solid rocket motors N84-15603
SOLID ROCKET PROPELLANTS
Propellant nonlinear constitutive theory extension: Preliminary results
[AD-A133364] N84-15287
SOLID SOLUTIONS
Compositional segregation in unidirectionally solidified solid solution crystals N84-16055
SOLID STATE DEVICES
The concept of a solid state direct chamber N84-15924
SOLIDIFICATION
Influence of alloying on the properties of nickel in the solid and liquid states
[BLL-M-35284-(5828.4)] N84-15232
Rapid solidification processing and powder metallurgy of Al alloys
[AD-A133873] N84-15250
Analytical and numerical solution for a solidifying liquid alloy slab N84-16025
Determination of systems suitable for study as monotectic binary metallic alloy solidification models N84-16050
Compositional segregation in unidirectionally solidified solid solution crystals N84-16055
SOLIDS
Report and recommendations for improving constitutive relations used in computer codes --- shock mechanics in solids
[AD-A133239] N84-15823
Interactions of vibrationally excited molecules with solid surfaces
[AD-A133449] N84-15950
Investigation of a para-ortho hydrogen reactor for application to spacecraft sensor cooling
[NASA-CR-175131] N84-15957
An NMR study of solid hydrogen using packer solid echoes and rotating reference frame relaxation N84-15992
SOLUBILITY
Crazing and fatigue behaviour of one and two phase polymers N84-15282
SOLVENTS
Polymer coated electrodes in ambient temperature molten salts
[AD-A133202] N84-15220
SOOT
Scattering and absorption of light by soot particles
[DE84-002308] N84-15967
SORPTION
A general computer model for predicting the performance of gas sorption refrigerators N84-15349
SOUND FIELDS
The numerical synthesis and inversion of acoustic fields using the Hankel transform with application to the estimation of the plane wave reflection coefficient of the ocean bottom
[AD-A133156] N84-15901
SOUND GENERATORS
Generation of sound in turbulent shear flows N84-15031
SOUND PRESSURE
Study of noise-certification standards for aircraft engines. Volume 2: Procedures for measuring far field sound pressure levels around an outdoor jet-engine test stand
[AD-A133408] N84-15158
Spinning mode acoustic radiation from the flight inlet
[NASA-CR-172273] N84-15896
Acoustic shocks in a variable area duct containing near sonic flows
[NASA-CR-172274] N84-15897
SOUND PROPAGATION
The parabolic approximation for sound propagation in stratified moving media N84-15893
Transonic noise generation by duct and profile flow
[AD-A129367] N84-15899
Marine environmental acoustics
[AD-A133245] N84-15902
SOUND WAVES
Spinning mode acoustic radiation from the flight inlet
[NASA-CR-172273] N84-15896
Aerodynamic sources of acoustic radiation from a single MOD-2 wind turbine
[DE84-000013] N84-15905
SOUNDING
Determination of propagation limitations at HF by real-time update of a computer model from oblique sounder data N84-15660
SOUNDING ROCKETS
Fine pointing control of the solar UV telescope on the sounding rocket S-520-5
[ISAS-608] N84-16094
SPACE CHARGE
Extraction of volume produced H(-) or D(-) ions from a sheet plasma I
[IPPJ-645] N84-15974
The effects of space charge on ionic mobility measurements in cylindrical geometries N84-15993
SPACE MAINTENANCE
Mechanical fastener
[NASA-CASE-LAR-12738-2] N84-15180
Hot melt recharge system --- space maintenance
[NASA-CASE-LAR-12881-2] N84-15271
SPACE MANUFACTURING
Commercialization of opportunities for materials processing in low gravity
[NASA-CR-170953] N84-15165
SPACE PERCEPTION
Visual routines
[AD-A133634] N84-15792
SPACE PROCESSING
Significant scientific and technical results at Marshal Space Flight Center
[NASA-TM-82562] N84-16075
SPACE PROGRAMS
Chicago Meets Outer Space program
[NASA-TM-85492] N84-16021
SPACE SHUTTLE BOOSTERS
Preflight transient dynamic analyses of B-52 aircraft carrying Space Shuttle solid rocket booster drop-test vehicle
[NASA-TM-84925] N84-15588
SPACE SHUTTLE MAIN ENGINE
Linear and nonlinear aspects of rotordynamics N84-16034
SPACE SHUTTLE ORBITERS
Engineering evaluations and studies. Volume 1: Exhibit A
[NASA-CR-171724] N84-15174
SPACE SHUTTLE PAYLOADS
Engineering evaluations and studies. Volume 2: Exhibit B, part 1
[NASA-CR-171725] N84-15175
SPACE SHUTTLES
Mission definition study for a VLBI station utilizing the Space Shuttle
[NASA-CR-175126] N84-15173
Engineering evaluations and studies. Volume 2: Exhibit B, part 2
[NASA-CR-171726] N84-15176
Atomic oxygen effects on materials N84-16036
Chronology of KSC and KSC related events for 1981
[NASA-TM-85510] N84-16060
SPACE STATIONS
Thermal analysis research applicable to space station technology needs
[NASA-TM-84658] N84-15426
SPACE TRANSPORTATION SYSTEM
Chronology of KSC and KSC related events for 1981
[NASA-TM-85510] N84-16060
SPACECRAFT
A general computer model for predicting the performance of gas sorption refrigerators N84-15349
SPACECRAFT CHARGING
Proton electrostatic analyzer
[AD-A133588] N84-15528
SPACECRAFT COMPONENTS
Spacecraft-borne long life cryogenic refrigeration: Status and trends N84-15331
Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space
[NASA-TM-85066] N84-15555
Activities report of the European Space Tribology Laboratory (ESTL)
[ESA-ESTL-55] N84-15563
SPACECRAFT DESIGN
ACOSS Fourteen (Active Control of Space Structures)
[AD-A133411] N84-15181
Study on damping representation related to spacecraft structural design
[EMSB-18/83] N84-15182
Thermal analysis research applicable to space station technology needs
[NASA-TM-84658] N84-15426
SPACECRAFT LUBRICATION
Activities report of the European Space Tribology Laboratory (ESTL)
[ESA-ESTL-55] N84-15563
SPACECRAFT SHIELDING
Mechanical fastener
[NASA-CASE-LAR-12738-2] N84-15180
Development of an improved protective cover/light block for multilayer insulation
[NASA-TM-82563] N84-15269
SPACECRAFT STRUCTURES
ACOSS Fourteen (Active Control of Space Structures)
[AD-A133411] N84-15181
SPACELAB
Payload missions integration
[NASA-CR-170949] N84-15171
The European Space Agency's Earth observation satellite programmes N84-15647
Space telescope
[NASA-CR-170948] N84-16097
SPARE PARTS
An approach to logistic problems by the L-transform method N84-15884
SPATIAL DISTRIBUTION
Combustion at the interface of an oxidizer-fuel slab system N84-15215
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602
Part 1: Physical studies of distant comets. Part 2: Morphologies of planetary nebulae N84-16091
SPATIAL FILTERING
Edge- and contour detection for correction of low-pass filtered images
[PB83-217489] N84-15969
SPATIAL RESOLUTION
10 cm radar ground clutter measurements taken from a coastal steamer radar on passage from Bergen to North Cape in May 1982 N84-15667
SPECIFIC HEAT
Heat capacity and thermodynamic properties of linear macromolecules N84-15283
Specific heat of He-3 in the Fermi liquid region
[DE83-011566] N84-13009
SPECIFICATIONS
Split-Stirling-cycle displacer linear-electric drive N84-15343
Investigations on the reproducibility of the results of drop weight tests by the method of W. S. Pellini
[BLL-DRIC-T-6970-(3623.66)] N84-15517
SPECTRAL RECONNAISSANCE
Development of visible/infrared/microwave agriculture classification and biomass estimation algorithms, volume 2 --- Oklahoma and Texas
[E84-10059] N84-15629
SPECTRAL REFLECTANCE
In-flight absolute radiometric calibration of the thematic mapper
[E84-10064] N84-15633
SPECTRAL RESOLUTION
Spectral characterization of the LANDSAT thematic mapper sensors
[E84-10065] N84-15634
A correlation analysis of percent canopy closure versus TMS spectral response for selected forest sites in the San Juan National Forest, Colorado
[E84-10066] N84-15635
Stationary stochastic processes --- spectrum analysis
[ESA-TT-812] N84-15875
SPECTROGRAPHS
Interfacing a two-stage image intensifier tube to an echelle spectrograph N84-16035
SPECTROMETERS
Proton electrostatic analyzer
[AD-A133588] N84-15528
Major detectors in elementary particle physics
[LBL-91] N84-15910
Experience of the axial field spectrometer at the CERN ISR N84-15912
Searching for limitations in capability due to high average rates N84-15919
Jet-impact nebulization for sample introduction in inductively coupled plasma spectrometry
[AD-A133152] N84-15982
Development of a mercuric iodide solid state spectrometer for X-ray astronomy
[NASA-CR-175330] N84-16096
SPECTROSCOPIC ANALYSIS
Spectroscopic studies on surface reactions between minerals and reagents in flotation systems N84-15324

SPECTROSCOPY
Surface analysis by particle beams N84-15301
Surface and near-surface analysis of diamond by RBS N84-15302
Mossabauer spectroscopy study of amorphous Fe87B11Au2 ribbon and its crystallization products [DE83-018091] N84-16010

SPECTRUM ANALYSIS
Increased confidence in spectrum matching by use of a retention time library --- compound identification in industrial effluents [PB83-232090] N84-15229
ECM (Electronic Counter Measure) signal discrimination and identification techniques [AD-A133427] N84-15372
Comparison of steady state transitions in truncated spectral and finite difference models of two-dimensional shallow convection N84-15417
Site-dependent inelastic response spectra N84-15620
Clear atmospheric effects on insolation illustrated by broad-band radiometer measurements N84-15701
Stationary stochastic processes --- spectrum analysis [ESA-TT-812] N84-15875
A radar signal processor implemented with surface acoustic waves devices N84-15889
Optical properties of natural minerals and other materials in the 350-50000 cM-1 spectral region [AD-A133530] N84-15965

SPEECH RECOGNITION
Increased aircraft survivability using direct voice input N84-15100

SPHERES
Optical multiple sample vacuum integrating sphere [NASA-CASE-GSC-12849-1] N84-15960

SPHERICAL COORDINATES
Three-dimensional, time-dependent, compressible, turbulent, integral boundary-layer equations in general curvilinear coordinates and their numerical solution [AD-A133269] N84-15504

SPHERICAL HARMONICS
Magnetic anomalies in east Pacific using MAGSAT data [E84-10060] N84-15630

SPHERICAL WAVES
The relation between power and energy in the shock initiation of detonations. 1: Basic theoretical considerations and the effects of geometry [AD-A133468] N84-15505

SPIN DYNAMICS
Spinning mode acoustic radiation from the flight inlet [NASA-CR-172273] N84-15896
An NMR study of solid hydrogen using packer solid echoes and rotating reference frame relaxation N84-15992

SPIN REDUCTION
A feasibility study of electromagnetic DE-spin system for Earth orbiting satellites N84-16040

SPIRAL GALAXIES
Low-ionization emission regions in the nuclei of spiral galaxies N84-16100

SPOILERS
An experimental study of airfoil-spoiler aerodynamics N84-15133

SPOT (FRENCH SATELLITE)
Study of the onboard calibration equipment of the HRV camera --- SPOT satellite [ESA-TT-794] N84-15529

SPRAYED COATINGS
Feasibility of thermal NDE methods for Naval thermal spray coatings [DE84-001463] N84-15569

SPREAD SPECTRUM TRANSMISSION
Spread spectrum transmission. Part 1: General characteristics [FUB-49-1982-PT-1] N84-15385
Adaptive protection of detecion systems operating by spread spectrum N84-15652

SPUTTERING
Comparative study of TiN hard coatings produced by reactive sputtering, ion-plating and CVD technique [BLL-RARDE-TR-1094(7291.7965)] N84-15236
Sputtering of multicomponent materials N84-15312
A formula for the sputtering yield of polycrystalline materials N84-15313
Quantitative sputter profiling at surfaces and interfaces N84-15314
Depth resolution due to instrumental factors in sputter-assisted depth profiling N84-15315
Progress in polycrystalline thin-film solar cells [DE83-012131] N84-15691
Fabrication and properties of multilayer structures [NASA-CR-174506] N84-15997

STABILITY
Simulated precipitation reference materials, 4 [PB83-139378] N84-15742

STABILIZATION
Beam current limitations due to instabilities in modified and conventional betatrons [AD-A133337] N84-15947

STACKING FAULT ENERGY
Dip-moveout by Fourier transform N84-15699

STAINLESS STEELS
Tensile and compressive constitutive response of 316 stainless steel at elevated temperatures [NASA-TM-83506] N84-15249
Pit initiation resistance of ferritic stainless steels in chloride environments from 800 to 2600C [DE84-000355] N84-15258
Ultrasonic test data acquisition and defect verification of stainless steel welds at 4000 deg F [DE83-012146] N84-15570

STANDARDS
Research towards and development of aerospace vehicle noise certification with emphasis on propeller aircraft and helicopters N84-15026
DEF STAN 00-18: A family of compatible digital interface standards N84-15049
Helix and Felix: Loading standards for use in the fatigue evaluation of helicopter rotor components [NLR-MP-82041-U] N84-15149
Study of noise-certification standards for aircraft engines. Volume 2: Procedures for measuring far field sound pressure levels around an outdoor jet-engine test stand [AD-A133408] N84-15158
Simulated precipitation reference materials, 4 [PB83-139378] N84-15742
Incentives for controlling the performance of high technology and professional employees [AD-A134074] N84-16061

STARK EFFECT
Application of the density matrix multipole expansion to stark quantum beats from beam-foil-excited hydrogen atoms [AD-A133603] N84-15193

STATIC ELECTRICITY
A systematic characterization of the effects of atmospheric electricity on the operational conditions of aircraft N84-15086

STATIC LOADS
The effect of superposing ripple loading of maneuver load cycles [AD-A132653] N84-15148

STATISTICAL ANALYSIS
Statistic prediction techniques of rain attenuation starting from pluviometric statistics --- microwave attenuation [FUB-51-1982] N84-15387
Integrated evaluation of the quality of steel cable wire [BLL-M-35267-(5828.4)] N84-15564
Site-dependent inelastic response spectra N84-15620
Pilot climate data system: A state-of-the-art capability in scientific data management [NASA-TM-85115] N84-15731
Application of the Gibbs distribution to image segmentation [AD-A133406] N84-15850
Statistical analysis of a debugging model N84-16048

STATISTICAL CORRELATION
A correlation analysis of percent canopy closure versus TMS spectral response for selected forest sites in the San Juan National Forest, Colorado [E84-10066] N84-15635

STATISTICAL DECISION THEORY
The 2-stage selection procedures based on tests [AD-A133405] N84-15871

STATISTICAL DISTRIBUTIONS
On the fitting of Pearson curves to sums of independent random variables [AD-A133153] N84-15844
Assessment of Fisher and logistic linear quadratic discrimination models [ORNL/CSD-TM-200] N84-15865

STATISTICAL TESTS
The 2-stage selection procedures based on tests [AD-A133405] N84-15871

STEADY FLOW
Computation of steady internal flows using integral representation methods with finite series expansions N84-15418

STEADY STATE
Sodium boiling experiments in bundle geometries under fast transient and steady state conditions --- fast breeder reactor safety analysis N84-15496
Theoretical simulation of thermohydraulic behavior of sodium cooled subassemblies in steady state and transient conditions --- liquid metal fast breeder reactors (LMFBR) N84-15498
Numerical solution to the steady state equation of transfer in azimuthally symmetric geometries --- heat transfer and molecular flow [DE84-001781] N84-15509

STEAM
Aerodynamics and steam wetness fraction of a multistage turbine. Comparison of prediction with experimental data N84-15475
Influence of Ar + CO2 shielding on the composition of a Cr-Mo-V weld [BLL-CE-TRANS-6000-(9022.09)] N84-15550

STEAM FLOW
Turbine aerodynamic design using through-flow theory. Meridional through-flow calculation N84-15474
Measurements in steam turbines N84-15476
Applications of through-flow theory --- steam turbines N84-15477
Wet steam flow in L. P. turbines --- low pressure (LP) N84-15483

STEAM TURBINES
Aerothermodynamics of Low Pressure Steam Turbines and Condensers, volume 1 --- conferences [VKI-LS-1983-06-VOL-1] N84-15472
The design of modern Low Pressure (LP) steam turbines N84-15473
Turbine aerodynamic design using through-flow theory. Meridional through-flow calculation N84-15474
Aerodynamics and steam wetness fraction of a multistage turbine. Comparison of prediction with experimental data N84-15475
Measurements in steam turbines N84-15476
Applications of through-flow theory --- steam turbines N84-15477
Trends in steam turbine design, testing and manufacturing N84-15478
A review of current research activity on the aerodynamics of axial flow turbines N84-15480
Three-dimensional flow calculations on a hypothetical steam turbine last stage N84-15481
Aerothermodynamics of Low Pressure Steam Turbines and Condensers, Volume 2 --- conferences [VKI-LS-1983-06-VOL-2] N84-15482
Wet steam flow in L. P. turbines --- low pressure (LP) N84-15483
Two dimensional condensing flow in transonic turbine cascades N84-15484
Steam condenser thermal design theories N84-15485
Steam condenser developments N84-15486

STEELS
Comparison of fracture-toughness measurements from ferritic-steel compact-tension and surface-flawed specimen [DE84-000895] N84-15240
Embrittlement of steels due to galvanizing or coating with zinc paint: An investigation of embrittlement in welding or heating operations --- liquid metal embrittlement [AERE-TR-4774] N84-15244
Integrated evaluation of the quality of steel cable wire [BLL-M-35267-(5828.4)] N84-15564

STEERING
Adaptive arrays for multiple simultaneous desired signals [AD-A133486] N84-15373

STELLAR CORONAS
X-ray observations of cataclysmic variables N84-16084

STELLAR EVOLUTION
Aperture synthesis observations of star forming regions: Compact H2 regions and masers N84-16092
Ambipolar diffusion in interstellar clouds: One-dimensional, isothermal collapse N84-16099

STELLAR MODELS
Numerical simulations of convectively excited gravity waves [DE84-001867] N84-15718

STELLAR RADIATION
Near infrared studies of reflection nebulae N84-16086

STELLAR SPECTRA
Line profile variability in winds of OB stars N84-16085
Optical and X-ray selected samples of quasars: Evolution of the luminosity distributions N84-16090

STELLAR SPECTROPHOTOMETRY
Infrared measurements of AFGL (Air Force Geophysics Laboratory) sources [AD-A133553] N84-16098

STELLAR WINDS
Line profile variability in winds of OB stars N84-16085

STELLARATORS
Equilibrium studies for low-aspect-ratio torsatrons [DE84-002264] N84-15979
Elimination of stochasticity in stellarators [DE84-001560] N84-15965

STIFFNESS
Static and dynamic stiffness reduction of graphite/epoxy composite laminates under fatigue loading N84-15194
Stiffness changes in unidirectional composites caused by crack systems
[CA-8311] N84-15198
Acoustical modes of arbitrary volumes using NASTRAN transient heat transfer RF9 N84-15597
An alternative method of analysis for base accelerated dynamic response in NASTRAN N84-15598
An investigation of the use of iterative linear equation solvers in codes for large stiff systems of ODE's
[AD-A133189] N84-15845
Stiffness properties for dynamic modeling of composite graphite-epoxy cylindrical orthotropic shells N84-16054
STIMULATION
Neuronal adaptive mechanisms underlying intelligent information processing
[AD-A133694] N84-15776
STIRLING CYCLE
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246
A cryocooler for applications requiring low magnetic and mechanical interference N84-15333
An approach to optimization of low-power Stirling cryocoolers N84-15334
Regeneration efficiency, shuttle heat loss and thermal conductivity in epoxy-composite annualr gap regenerators from 4K to 80K N84-15335
A 10 deg K triple-expansion Stirling-cycle cryocooler N84-15336
Split-Stirling-cycle displacer linear-electric drive N84-15343
Computer program for analysis of split-Stirling-cycle cryogenic coolers N84-15344
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space
[NASA-TM-85066] N84-15555
Stirling engines with controlled evaporation of a two-phase two-component working fluid
[DE83-017284] N84-15560
STOCHASTIC PROCESSES
Development and perturbation analysis of model stochastic equations for global circulation N84-15743
An algorithm for detecting a change in stochastic process
[AD-A134104] N84-15842
Stationary stochastic processes --- spectrum analysis
[ESA-TT-812] N84-15875
STOICHIOMETRY
Progress in polycrystalline thin-film solar cells
[DE83-012131] N84-15691
STORAGE STABILITY
Calcium-thionyl chloride battery technology
[AD-A133570] N84-15401
STORAGE TANKS
Permeability of flexible materials used in fuel storage tanks. Part 2: A method of measurement and preliminary results
[AD-A133451] N84-15558
STRAIN RATE
Yield stress of type 21-6-9 stainless steel over a wide range of strain rate (10(-5) to 10-4 s(-1)) and temperature
[DE83-017159] N84-15259
STRATIFICATION
Mixed convection and stratification phenomena in liquid metals N84-15488
STRATIFIED FLOW
The parabolic approximation for sound propagation in stratified moving media N84-15893
STRATUS CLOUDS
Radiative-dynamic properties of Arctic stratus clouds and their possible modification by aerosol particles
[DFVLR-FB-83-23] N84-15740
STREAMS
Spatial reasoning to determine stream network from LANDSAT imagery
[E84-10063] N84-15632
STRESS (PHYSIOLOGY)
Stress fractures: The remodelling response to excessive repetitive loading
[AD-A130881] N84-15765
Variable inhibition by falling CO2 of hypoxic ventilatory response in man
[AD-A130658] N84-15768
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
STRESS ANALYSIS
Strength theories of continuous and discontinuous fiber composites N84-15195
User's manual for GAMNAS: Geometric and Material Nonlinear Analysis of Structures
[NASA-TM-85734] N84-15200
Analysis of interlaminar stresses in thick composite laminates with and without edge delamination
[NASA-TM-85738] N84-15201
Crazing and fatigue behaviour of one and two phase polymers N84-15282
The structure of turbulent entraining flow in an annulus with a rotating screen N84-15416
Nonlinear analysis of thin shells by the hybrid mixed finite-element method N84-15578
Orthotropic hole element N84-15595
Stress measurements in ice
[AD-A133906] N84-15609
We need simplicity and speed. Some examples of simple and fast methods for the measurement of deformations of structures
[NLR-MP-82021-U] N84-15616
A three-dimensional photoelastic investigation of stresses and cracks formed in concrete around deformed reinforcing bars N84-15621
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics
[AD-A133142] N84-15843
STRESS CONCENTRATION
We need simplicity and speed. Some examples of simple and fast methods for the measurement of deformations of structures
[NLR-MP-82021-U] N84-15616
STRESS INTENSITY FACTORS
Comparison of fracture-toughness measurements from ferritic-steel compact-tension and surface-flawed specimen
[DE84-000895] N84-15240
Brief note of the stress intensity factor of elliptical cracks
[PB83-216911] N84-15618
Investigation of static and dynamic fracture of orthotropic media by photomechanics N84-15625
Microcrack damage model of brittle rock
[DE84-002088] N84-15717
STRESS MEASUREMENT
We need simplicity and speed. Some examples of simple and fast methods for the measurement of deformations of structures
[NLR-MP-82021-U] N84-15616
STRESS WAVES
Input-output characterization of an ultrasonic testing system by digital signal analysis
[NASA-CR-3756] N84-15565
STRESS-STRAIN RELATIONSHIPS
Fatigue damage-strength relationships in composite laminates. Volume 1
[AD-A133485] N84-15206
Tensile and compressive constitutive response of 316 stainless steel at elevated temperatures
[NASA-TM-83506] N84-15249
Asymmetric turbulent flows N84-15451
Theoretical and experimental determination of stress-strain of high-pressure equipment
[BLL-M-35287-(5828.4)] N84-15574
A comprehensive numerical study and experimental verification of endochronic plasticity N84-15579
STRESSES
Theoretical and software considerations for nonlinear dynamic analysis
[NASA-CR-174504] N84-15589
STRONG INTERACTIONS (FIELD THEORY)
Lattice gauge theories
[DE83-013114] N84-15906
STRONGLY COUPLED PLASMAS
Jet-impact nebulization for sample introduction in inductively coupled plasma spectrometry
[AD-A133152] N84-15982
STRUCTURAL ANALYSIS
ACOSS Fourteen (Active Control of Space Structures)
[AD-A133411] N84-15181
User's manual for GAMNAS: Geometric and Material Nonlinear Analysis of Structures
[NASA-TM-85734] N84-15200
Thermal analysis research applicable to space station technology needs
[NASA-TM-84658] N84-15426
Eleventh NASTRAN User's Colloquium
[NASA-CP-2284] N84-15590
NASA/MSFC NASTRAN auxiliary I/O routines N84-15592
Using PAFEC as a preprocessor for COSMIC/NASTRAN N84-15593
The GPRIME approach to finite element modeling N84-15594
Generalizing the TRAPRG and TRAPAX finite elements N84-15596
Dynamic certification of a thrust-measuring system for large solid rocket motors N84-15603
A new method for generating and maintaining rigid formats in NASTRAN N84-15605
Implementation of elastic-plastic structural analysis into NASTRAN N84-15606
Elastic-plastic analysis of annular plate problems using NASTRAN N84-15607
Bolt in bore boundaries N84-15608
Analysis of plates by the initial-value method N84-15622
Efficient large-scale finite-element computations in a CRAY environment
[DE83-014946] N84-15818
A survey of solution techniques for nonlinear finite element equations
[NLR-MP-82027-U] N84-15861
STRUCTURAL DESIGN
Design, development and flight test of a demonstration advanced avionics system N84-15067
Study on damping representation related to spacecraft structural design
[EMSB-18/83] N84-15182
Turbine aerodynamic design using through-flow theory. Meridional through-flow calculation N84-15474
Trends in steam turbine design, testing and manufacturing N84-15478
Steam condenser thermal design theories N84-15485
Steam condenser developments N84-15486
Design procedures for compressor blades
[NASA-TM-77085] N84-15552
STRUCTURAL DESIGN CRITERIA
The design of modern Low Pressure (LP) steam turbines N84-15473
Eleventh NASTRAN User's Colloquium
[NASA-CP-2284] N84-15590
The dynamic response characteristics of a viscoelastic beam on periodically-spaced, viscoelastic supports N84-15619
STRUCTURAL ENGINEERING
The design of modern Low Pressure (LP) steam turbines N84-15473
The GPRIME approach to finite element modeling N84-15594
Material selection and structural design for safety and durability
[NLR-MP-82023-U] N84-15617
The dynamic response characteristics of a viscoelastic beam on periodically-spaced, viscoelastic supports N84-15619
Computer-Aided Structural Engineering (CASE) project. Reference manual: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133493] N84-15828
STRUCTURAL FAILURE
Interaction of gas explosions with buildings N84-15447
STRUCTURAL MEMBERS
Energy Materials Coordinating Committee (EMACC). Contractors Meeting on Problems and Opportunities in Structural Ceramics
[CONF-8209111] N84-15266
Interaction of gas explosions with buildings N84-15447
Eleventh NASTRAN User's Colloquium
[NASA-CP-2284] N84-15590
STRUCTURAL PROPERTIES (GEOLOGY)
Synthesis of regional crust and upper-mantle structure from seismic and gravity data
[E84-10061] N84-15631
STRUCTURAL STABILITY
Wind tunnel tests on a model of a semisubmersible platform and comparison of the results with full-scale data
[NLR-MP-82014-U] N84-15113
SUBMARINES
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
SUBMERGING
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602
SUBROUTINES
Calculation of cosmic ray induced single event upsets: Program CRUP (Cosmic Ray Upset Program)
[AD-A133620] N84-16113
SUBSONIC FLOW
Iterative solution of the finite difference potential equations for subsonic and transonic flows N84-15436
Some new developments in exact integral equation formulations for sub- or transonic potential flow
[NLR-MP-82024-U] N84-15860

SUBSTRATES
The influence of weakly polarized surfaces on different kinds of thin layer systems N84-15309
Structural properties of epitaxial single layer metals on (110) B.C.C. metal substrates N84-15326
Replicated CdTe substrates
[AD-A133114] N84-15994
SULFATES
Exposure chamber for studies of pollutant gases and aerosols in human subjects: Design considerations
[DE84-001135] N84-15785
SULFONATES
Luminescence probe studies of nafion polyelectrolytes
[AD-A133519] N84-15224
SULFUR CHLORIDES
Calcium-thionyl chloride battery technology
[AD-A133570] N84-15401
SULFURIC ACID
Exposure chamber for studies of pollutant gases and aerosols in human subjects: Design considerations
[DE84-001135] N84-15785
SUNLIGHT
Techniques for measuring radiance in the air and sea N84-15672
SUPERCONDUCTING MAGNETS
Utilization of low temperatures in electrical machines
[AD-A133325] N84-15399
SUPERCONDUCTIVITY
Superconducting ground state of a strongly interacting electron system: UBe13
[DE84-001708] N84-16003
Superconducting properties of Nb3Sn multifilamentary wires fabricated by internal tin process
[DE83-018189] N84-16011
Role of pressure in understanding the anomalous superconductivity in europium (molybdenum)6(sulfur)8 and (TMTSF)2FSO3
[DE83-017292] N84-16012
SUPERCONDUCTORS
US Navy program in small cryocoolers N84-15328
Utilization of low temperatures in electrical machines
[AD-A133325] N84-15399
SUPERFLUIDITY
A report on superfluid helium flow through porous plugs for space science applications N84-16043
SUPERHIGH FREQUENCIES
Engineering evaluations and studies. Volume 1: Exhibit A
[NASA-CR-171724] N84-15174
Engineering evaluations and studies. Volume 2: Exhibit B, part 1
[NASA-CR-171725] N84-15175
Statistical data on anomalous propagation in the Tyrrhenian Sea using an X-band link N84-15668
A digital ferrite phase-shifter for high power S-band operation N84-15886
Characteristics of RF lightning emission at 2 GHz and 250 MHz N84-16039
SUPERLATTICES
InAsSb strained-layer superlattices for long wavelength detector applications
[DE84-001055] N84-16004
An In0 2Ga0 8As/GaAs, modulation-doped, strained-layer superlattice field-effect transistor
[DE84-000136] N84-16006
SUPERSONIC AIRCRAFT
Pilot human factors in stall/spin accidents of supersonic fighter aircraft N84-15102
SUPERSONIC CRUISE AIRCRAFT RESEARCH
Inlet flow field investigation. Part 1: Transonic flow field survey
[NASA-CR-172239] N84-15123
SUPERSONIC FLIGHT
A wing concept for supersonic maneuvering
[NASA-CR-3763] N84-15115
SUPERSONIC FLUTTER
Helicopter blade tips
[NASA-TM-77370] N84-15119
SUPERSONIC JET FLOW
The CARS spectroscopy in a supersonic jet N84-15216
A study of accretion in compact sources: Disk precession and jet helicity N84-16038
SUPERSONIC TURBINES
Two dimensional condensing flow in transonic turbine cascades N84-15484
SURFACE ACOUSTIC WAVE DEVICES
Rivista Tecnica Selenia, volume 8, number 3, 1983 N84-15887
A radar signal processor implemented with surface acoustic waves devices N84-15889
SURFACE FINISHING
Methods in competition with electroplating
[BLL-OA-TRANS-3037-(6196.3)] N84-15213
SURFACE GEOMETRY
Computer-Aided Structural Engineering (CASE) project. Reference manual: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133493] N84-15828
SURFACE IONIZATION
Experimental studies of secondary ion emission from well-characterized surfaces
[AD-A133186] N84-15943
SURFACE LAYERS
Sputtering of multicomponent materials N84-15312
Depth resolution due to instrumental factors in sputter-assisted depth profiling N84-15315
SURFACE PROPERTIES
The measurement of surface texture and its correlation with function N84-15299
Surface analysis by particle beams N84-15301
The unique surface properties of gold N84-15310
Quantitative sputter profiling at surfaces and interfaces N84-15314
Diffraction techniques
[AD-A133254] N84-15944
Technical support for AXAF
[NASA-CR-170950] N84-15959
SURFACE REACTIONS
Effect of UV illumination on the sublimation of basal surfaces of zinc oxide
[AD-A133383] N84-15222
Proceedings of Symposium on Surface Science and its Industrial Implications
[ISBN-0-7988-2417-4] N84-15298
Etching of defects on crystal surfaces N84-15300
Secondary ion emission from adsorbate layers on polycrystalline Ni N84-15306
Oxygen adsorption and initial oxidation of single crystal first row transition metal and alloy surfaces N84-15316
Kinematics of the structure and morphology during surface reactions between transition metals and molecular hydrogen N84-15317
Use of scanning electron microscopy in studying surface reactions of metals with hydrogen N84-15318
Surface segration and diffusion investigations by means of AES N84-15319
The descaling of 3Cr12 steel N84-15322
Surface chemistry in the flotation of minerals N84-15323
Spectroscopic studies on surface reactions between minerals and reagents in flotation systems N84-15324
Emission of short-wavelength photons from ion-surface charge exchange
[AD-A133183] N84-15942
Interactions of vibrationally excited molecules with solid surfaces
[AD-A133449] N84-15950
SURFACE ROUGHNESS
The influence of surface roughness on the transfer and wear of polymers
[AD-A133527] N84-15275
Design and microprocessor-based implementation of digital frequency selective filters for application in terrain roughness identification
[AD-A133459] N84-15826
SURFACE TEMPERATURE
An analysis of aircraft data collected in the Alboran Sea during Donde Va?, 6 - 18 October 1982
[AD-A133995] N84-15746
SURFACE VEHICLES
Flywheel energy-management systems for improving fuel economy of motor vehicles
[DE84-002340] N84-15688
SURFACE WATER
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data
[E84-10068] N84-15637
The advection of submesoscale thermal features in the Alboran Sea Gyre
[AD-A133877] N84-15749
Short-term measurements of surface currents associated with the Alboran Sea during Donde Va?
[AD-A133812] N84-15750
SURFACE WAVES
Constraints on the Earth's anelastic and aspherical structure from antipodal surface waves N84-15700
Surface wave path corrections, deterministic discrimination and body wave attenuation
[AD-A133574] N84-15714
SURFACES
Analysis of nonplanar wing-tip mounted lifting surfaces on low-speed airplanes N84-15142
SURGERY
Low X-ray absorption aneurism clips
[NASA-CASE-LAR-12650-2] N84-15764
SURGES
A new numerical method for the transient gas-dyanmic code EVENT
[LA-9594-MS] N84-15977
SURVEILLANCE
Distributed sensor network
[AD-A133250] N84-15903
SURVEYS
Census of US Civil aircraft. Calendar year 1982
[AD-A133161] N84-15033
Job attitudes toward the new maintenance concept of the airway facilities service
[AD-A133282] N84-15793
SURVIVAL
Medical aspects of survival: Training for aircrew
[AGARD-AG-283(FR)] N84-15787
SWELLING
Finite element analysis of moisture and external loading effects in composites N84-15211
SWEPT FORWARD WINGS
Wake characteristics and interactions of the Canard/wing lifting surface configuration of the X-29 forward-swept wing flight demonstrator
[AD-A133188] N84-15126
SWEPT WINGS
Three-dimensional wake of a swept wing N84-15458
SWIRLING
A numerical investigation of the multiple vortex phenomenon: Vortex number and structure as a function of swirl ratio N84-16049
SYMBOLS
Evaluation of map symbols for a computer generated topographic display: Transfer of training, symbol confusion, and association value studies
[AD-A133590] N84-15643
SYMMETRY
Flow improvements in the circuit of the Langley 4- by 7-meter tunnel
[NASA-TM-85662] N84-15117
Phase-only nulling at symmetric pattern locations
[AD-A133128] N84-15361
SYNCHRONISM
AFTI/F-16 flight test results and lessons
[NASA-TM-84920] N84-15159
Fast asynchronous level 1 pre-trigger for electrons at L = 10/sup 33 cm-2 sec-1 N84-15933
SYNCHRONOUS SATELLITES
Earth coverage corrugated horns (44.5 GHz and 20.7 GHz)
[AD-A133241] N84-15366
SYNCHROTRON RADIATION
Use of synchrotron radiation for electron identification at high luminosity N84-15935
Structural studies at elevated pressure and reduced temperatures using synchrotron radiation: Application to Ce.8La.1Th.1
[DE84-001793] N84-16007
SYNCHROTRONS
Decimetric gyrosynchrotron emission during a solar flare
[NASA-TM-85123] N84-16107
SYNOPTIC METEOROLOGY
Some effects of surface heating and topography on the regional severe storm environment N84-15723
FGGE/SMMR-30 tape specification and shipping letter description
[NASA-CR-170550] N84-16074
SYNTHESIS (CHEMISTRY)
The chemistry of transition metal carbene complexes
[AD-A133541] N84-15225
Synthesis and characterization of some thermotropic nematic and cholesteric polymers N84-15262
Chemistry, characterization and processing of IMC curing polymers
[AD-A133479] N84-15274
New polyconjugated oxidation-reduction polymers, as well as a method and apparatus for electrochemical regeneration
[DE84-002813] N84-15276
Theoretical and experimental determination of stress-strain of high-pressure equipment
[BLL-M-35287-(5828.4)] N84-15574
Fabrication and properties of multilayer structures
[NASA-CR-174506] N84-15997
Synthesis of N-substituted silaneamines: Monomeric precursors of silicon carbide-nitride fibers N84-16033
Ultrahigh molecular weight aromatic siloxane polymers N84-16042
SYNTHETIC APERTURE RADAR
Analysis of data acquired by synthetic aperture radar over Dade County, Florida, and Acadia Parish, Louisiana
[E84-10067] N84-15636
Remote sensing with spaceborne synthetic aperture imaging radars: A review N84-15648
Ocean wave imaging by SAR N84-15649

Propagation effects in satellite-borne synthetic aperture radars N84-15850
Application of the Gibbs distribution to image segmentation
[AD-A133406] N84-15850

SYNTHETIC FUELS
Gasogen for automobile use
[DE84-000712] N84-15291

SYNTHETIC RUBBERS
Rubber-modified epoxy and glass laminates for application to naval ship structures
[AD-A133305] N84-15204

SYSTEM EFFECTIVENESS
The performance of 16000 wire mini-drift MWPC system N84-15922

SYSTEMS ANALYSIS
A guideline for the planning and system requirement determination of a computer based educational system
[AD-A133529] N84-15829
Statistical analysis of a debugging model N84-16048

SYSTEMS COMPATIBILITY
Towards a modularity of software conceived for the requirement of the user N84-15040

SYSTEMS ENGINEERING
Critical factors and operational research in tactical fighter avionic system development N84-15062
CADAS: A computer aided design tool for avionic systems N84-15065
Design and verification of electromagnetic compatibility in airborne weapons systems N84-15066
Simulation requirements to support the development of a fault tolerant avionic system N84-15072
A dynamic approach to military avionics systems testing N84-15075
Validation of digital systems in avionics and flight control applications handbook, volume 1
[AD-A133222] N84-15150
AFTI/F-16 flight test results and lessons
[NASA-TM-84920] N84-15159
4.0 K cryocooler project
[DE84-000332] N84-15358
Preliminary designs for modifications to the X-ray source and beam monitor of the Marshall Space Flight Center's X-ray Calibration Facility N84-16032
Local automation model: Functional description
[AD-A133389] N84-16077

SYSTEMS INTEGRATION
Advanced Concepts for Avionics/Weapon System Design, Development and Integration
[AGARD-CP-343] N84-15034
Avionics/crew station integration N84-15042
Guidelines and criteria for the functional integration of avionic systems with crew members in command N84-15044
Connecting aircraft and external loads N84-15046
Towards the functional partitioning of highly integrated, fault tolerant avionics signal processors N84-15047
Advanced F/A-18 avionics N84-15048
A video bus for weapon system integration N84-15051
First level integrated maintenance in weapons systems N84-15054
A practical approach to the design of a new avionic system N84-15058
Integration of ICNIA into advanced high performance fighter aircraft N84-15059

SYSTEMS SIMULATION
Methods for developing the navigation and weapon systems of the Mirage 2000 N84-15068
Recent advances in variable speed electrical generator systems for large wind turbines
[DE84-001833] N84-15404

T

TACTICS
Critical factors and operational research in tactical fighter avionic system development N84-15062

TAIL ASSEMBLIES
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169
Determination of elevator and rudder hinge forces on the Learjet model 55 aircraft N84-15604

TAKEOFF
Aircraft operations from airfields with special unconventional characteristics N84-15085
Influence of windshear on flight safety N84-15088

TANTALUM
Effects of hydrogen on strength and ductility of tantalum N84-15260
Thermal and electrical interaction of tantalum with a low temperature chemically active plasma flow
[NASA-TM-77374] N84-15980

TARGET ACQUISITION
The lock-on-before-launch weapon delivery and display/control consideration N84-15056

TARGET RECOGNITION
Avionics concept evaluation at the force level N84-15036
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371
Optimum and sub-optimum processors for multistatic radar systems N84-15885

TARGETS
A 650 mm long liquid hydrogen target for use in a high intensity electron beam
[DE84-002552] N84-15955

TASKS
Organizational-climate dimensions: A conceptual and judgmental analysis
[AD-A132898] N84-16068

TDR SATELLITES
An evaluation of Techroll seal flexible joint material N84-16037

TEARING MODE (PLASMAS)
Computations of the current profile influence on tearing instability
[NASA-TM-77285] N84-15981
Sustained self-reversal in the reversed field pinch
[DE84-001559] N84-15990

TECHNETIUM COMPOUNDS
Environmental behavior of Technetium-99
[DP-1644] N84-15245

TECHNOLOGICAL FORECASTING
Trends in steam turbine design, testing and manufacturing N84-15478

TECHNOLOGY ASSESSMENT
Avionics/crew station integration N84-15042
Resin development in advanced composites
[FOA-C-20509-F9] N84-15208
Microwave tubes: Literature survey number 4, comprising the year 1982
[FOA-C-30331-E] N84-15407
A review of current research activity on the aerodynamics of axial flow turbines N84-15480
State-to-state unimolecular reaction dynamics
[DE84-003009] N84-15952

TECHNOLOGY UTILIZATION
Thermohydraulic applications of liquid metals in the non-nuclear field N84-15501
Artificial intelligence: An analysis of potential applications to training, performance measurement, and job performance aiding
[AD-A133592] N84-15839
Chicago Meets Outer Space program
[NASA-TM-85492] N84-16021

TECTONICS
Investigation of antarctic crust and upper mantle using MAGSAT and other geophysical data
[E84-10055] N84-15627
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields --- California and Pennsylvania
[E84-10057] N84-15628

TELECOMMUNICATION
Low rate transmission of video signals using adaptive delta modulation
[AD-A133145] N84-15363
Adaptive signal detection for the optimal communications receiver
[AD-A133498] N84-15374
Advanced teleprocessing systems
[AD-A133554] N84-15377
Advanced teleprocessing systems
[AD-A133555] N84-15378

TELEMETRY
Advanced techniques of laser telemetry N84-15883

TELEOPERATORS
Robotics-related technology in the nuclear industry
[DE83-017131] N84-15799
A FMCW radar ranging device for the teleoperator maneuvering system N84-16045

TELESCOPES
Technical support for AXAF
[NASA-CR-170950] N84-15959

TEMPERATURE
The long term upper ocean study (LOTUS). Cruise summary and hydrographic data report, ENDEAVOR 97, April 1983
[AD-A134005] N84-15745
An analysis of aircraft data collected in the Alboran Sea during Donde Va?, 6 - 18 October 1982
[AD-A133995] N84-15746

TEMPERATURE DEPENDENCE
Optimal design of gas adsorption refrigerators for cryogenic cooling N84-15348

TEMPERATURE DISTRIBUTION
Heat capacity and thermodynamic properties of linear macromolecules N84-15263
Computation of the temperature distribution due to eddy-currents in the wall of a power transformer
[PB83-217273] N84-15410
Temperature distributions, boiling and dry-out behind local blockages --- liquid metal fast breeder reactors (LMFBR) N84-15495
Heat generation in aircraft tires under braked rolling conditions
[NASA-CR-3768] N84-15587

TEMPERATURE EFFECTS
Elevated temperature low cycle fatigue of nickel base superalloys in the conventionally cast, directionally solidified and single crystal forms
[AD-A133598] N84-15253
The influence of the environment on the mechanical characteristics of composite materials: Design considerations --- polymer matrix composites
[INTA-INFORME-I-1/221/720/83047] N84-15281
Aspects of damping of sonic vibrations due to impact loading in plate steels
[BLL-M-35295-(5828.4)] N84-15895

TEMPERATURE GRADIENTS
Aerothermal modeling, phase 1. Volume 2: Experimental data
[NASA-CR-168296-VOL-2] N84-15156
Tensile and compressive constitutive response of 316 stainless steel at elevated temperatures
[NASA-TM-83508] N84-15249
Design and use of nonstandard tensile specimens for irradiated materials testing
[DE84-001468] N84-15254
Effects of hydrogen on strength and ductility of tantalum N84-15260
Ocean temperature changes induced by tropical cyclones N84-15722

TEMPERATURE MEASUREMENT
Aerothermal modeling. Executive summary
[NASA-CR-168330] N84-15152
Acoustical modes of arbitrary volumes using NASTRAN transient heat transfer RF9 N84-15597
A diagnostic case study of the effects of deep extratropical convection on the large-scale temperature and moisture structure N84-15695

TEMPERATURE PROFILES
XCP measurements off California in October 1982: Cruise report and preliminary results
[AD-A133051] N84-15754

TEMPERING
Fracture resistance of hardened and tempered pipes of 16GFR steel
[BLL-M-35268-(5828.4)] N84-15584

TERNARY SYSTEMS
Study of phase diagrams of ternary semiconductors
[AD-A133556] N84-16000

TERRAIN
The future in terrain elevation data processing at the Defense Mapping Agency
[AD-A133483] N84-15641
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15851
Development of generic mobility-terrain data bases: Investigation of critical soil parameters
[AD-A133595] N84-15715

TEST CHAMBERS
Exposure chamber for studies of pollutant gases and aerosols in human subjects: Design considerations
[DE84-001135] N84-15785

TEST FACILITIES
Capabilities of the NRCC/NAE flight impact simulator facility
[AD-A130849] N84-15136
Liquid metal experimental facilities --- fast breeder reactors N84-15492

TESTS
Analog fault diagnosis of large-scale electronic circuits
[AD-A133491] N84-15400

TEXTURES
The measurement of surface texture and its correlation with function N84-15299
Spatial reasoning to determine stream network from LANDSAT imagery
[E84-10063] N84-15632
Optical flow and texture variables useful in simulating self motion (2)
[AD-A133597] N84-15779

THEMATIC MAPPING
Thematic mapper radiomtric variability on ostensibly uniform agricultural scenes
[E84-10035] N84-15626
Landsat 4 TM-data: Examples of resolution capacity
[FOA-C-30329-E1] N84-15644

THEOREMS
The 2-stage selection procedures based on tests
[AD-A133405] N84-15871
THERMAL CONDUCTIVITY
Second order theory of unsteady burned-anchored flames with arbitrary Lewis number
[CA-8313] N84-15219
Transport algorithms for methane flames
[AD-A133213] N84-15221
Optimal design of gas adsorption refrigerators for cryogenic cooling N84-15348
Thermal conductance and torque of thin section four-point contact ball bearings in vacuum
[ESA-ESTL-54] N84-15562
THERMAL CYCLING TESTS
Suitability of commercially available laboratory cryogenic refrigerators to support shipboard electro-optical systems in the 10 - 77 Kelvin region N84-15355
THERMAL ENERGY
High-temperature molten salt thermal energy storage systems for solar applications
[NASA-CR-167916] N84-15679
THERMAL INSULATION
Feasibility of thermal NDE methods for Naval thermal spray coatings
[DE84-001463] N84-15589
Partial analysis of Insta-Foam N84-16030
THERMAL RADIATION
Heat-storage materials for IRCM
[AD-A133110] N84-15961
THERMAL RESISTANCE
Heat transfer retardation at elevated temperatures. Phase 1: Analysis of heat transfer retardation configurations and materials
[AD-A133509] N84-16017
THERMAL VACUUM TESTS
Thermal conductance and torque of thin section four-point contact ball bearings in vacuum
[ESA-ESTL-54] N84-15562
Activities report of the European Space Tribology Laboratory (ESTL)
[ESA-ESTL-55] N84-15563
THERMODYNAMIC CYCLES
Testing and characterizations of infrared sensor over the temperature range of 2 Kelvin to 300 Kelvin N84-15347
THERMODYNAMIC PROPERTIES
Powder metallurgy
[BLL-M-35271-(5828.4)] N84-15231
Computer program for analysis of split-Stirling-cycle cryogenic coolers N84-15344
Thermodynamics of aqueous sodium chloride to 823 K and 1 kbar
[DE84-001841] N84-16019
THERMODYNAMICS
Journal of Engineering Thermophysics (selected articles)
[AD-A133167] N84-15184
Propellant nonlinear constitutive theory extension: Preliminary results
[AD-A133364] N84-15287
LARC: Computer codes for Lagrangian analysis of stress-guage data to obtain decomposition rates through correlation to thermodynamic variables
[DE84-002404] N84-15292
Fluid thermodynamics
[ESA-TT-778] N84-15512
A thermodynamically consistent constitutive model for inelastic flow of materials N84-15561
THERMOHYDRAULICS
Thermohydraulics of liquid metals, volume 1 — conferences
[VKI-LS-1983-07-VOL-1] N84-15487
Mixed convection and stratification phenomena in liquid metals N84-15488
Single phase sodium flow in complex and deformed generators N84-15489
Thermohydraulics in liquid metals N84-15491
Thermohydraulics of liquid metals, volume 2 — conferences
[VKI-LS-1983-07-VOL-2] N84-15494
The BLOW-3A: A theoretical model to describe transient two phase flow conditions in Liquid Metal Fast Breeder Reactor (LMFBR) coolant channels N84-15497
Theoretical simulation of thermohydraulic behavior of sodium cooled subassemblies in steady state and transient conditions — liquid metal fast breeder reactors (LMFBR) N84-15498
Computation of the thermohydraulics in subassemblies for accident situations — liquid metal fast breeder reactors (LMFBR) N84-15499
Thermohydraulics of LMFBR core catchers — liquid metal fast breeder reactors (LMFBR) N84-15500
Thermohydraulic applications of liquid metals in the non-nuclear field N84-15501
THERMOMETERS
An analysis of aircraft data collected in the Alboran Sea during Donde Va?, 6 - 18 October 1982
[AD-A133995] N84-15746
Specific heat of He-3 in the Fermi liquid region
[DE83-011566] N84-16009
THERMONUCLEAR REACTIONS
Theoretical calculation of rapid X-ray transients and radius expansion
[DE84-001312] N84-16114
THERMOPLASTIC FILMS
Hot melt recharge system — space maintenance
[NASA-CASE-LAR-12881-2] N84-15271
THERMOREGULATION
Heat exchange following atropine injection before and after heat acclimation
[AD-A132618] N84-15780
THICK PLATES
Propagating plane harmonic waves through finite length plates of variable thickness using finite element techniques N84-15601
THICKNESS
Analysis of interlaminar stresses in thick composite laminates with and without edge delamination
[NASA-TM-85738] N84-15201
Composite laminate weight optimization on the HX-20
[AD-A133490] N84-15207
An experimental investigation of the structure of a turbulent reattaching flow behind a backward-facing step N84-15415
THIN FILMS
Nonlinear viscoelastic characterization of structural adhesives
[NASA-CR-172279] N84-15268
Experience in surface analysis applied to technical material problems N84-15303
The use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition N84-15307
A new non-destructive and standardless method for the thickness determination of thin films by XRF measurement N84-15308
The influence of weakly polarized surfaces on different kinds of thin layer systems N84-15309
Progress in polycrystalline thin-film solar cells
[DE83-012131] N84-15691
THIN PLATES
Orthotropic hole element N84-15595
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602
Bending elasticity of circularly notched bars as monolithic flexure hinges in precision mechanisms
[DE84-002199] N84-15612
THIN WALLED SHELLS
Nonlinear analysis of thin shells by the hybrid mixed finite-element method N84-15578
Unified operator description, nonlinear buckling and post-buckling analysis of thin elastic shells
[RUB-IFM-MITT-34] N84-15582
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602
THREE BODY PROBLEM
Three-dimensional, periodic halo orbits in the restricted three-body problem N84-15167
THREE DIMENSIONAL BOUNDARY LAYER
Three-dimensional effects on airfoils
[NASA-TM-77025] N84-15118
Computations of projectile magnus effect at transonic velocities
[AD-A133212] N84-15127
Three-dimensional turbulent boundary layers in turbomachines N84-15460
Some notes on 3-dimensional turbulent boundary layer data and turbulence modeling
[NLR-MP-82007-U] N84-15513
THREE DIMENSIONAL FLOW
Three-dimensional wake of a swept wing N84-15458
Three-dimensional turbulent boundary layers N84-15459
A method of calculating fully three dimensional inviscid flow through any type of turbomachine blade row N84-15479
Three-dimensional flow calculations on a hypothetical steam turbine last stage N84-15481
Three-dimensional, time-dependent, compressible, turbulent, integral boundary-layer equations in general curvilinear coordinates and their numerical solution
[AD-A133289] N84-15504
THRESHOLDS (PERCEPTION)
Perception of higher derivatives of visual motion
[AD-A133908] N84-15773
THROTTLING
1981 CRC octane number requirement survey
[AD-A133369] N84-15288
THRUST MEASUREMENT
Dynamic certification of a thrust-measuring system for large solid rocket motors N84-15603
THRUST VECTOR CONTROL
Electrofluidic angular rate sensor for ejection seat thrust vector control
[AD-A133233] N84-15137
THUNDERSTORMS
Relationships between thunderstorm mesoscale circulation and tornadogenesis N84-15727
Airborne lightning characterization
[AD-A130627] N84-15733
Investigation of the arc cloud complex N84-16029
TIDES
Prototype tidal data analysis for Mississippi Sound and adjacent areas
[AD-A134071] N84-15744
TILES
Mechanical fastener
[NASA-CASE-LAR-12738-2] N84-15180
Hot melt recharge system — space maintenance
[NASA-CASE-LAR-12881-2] N84-15271
TIME DEPENDENCE
Exploiting temporal knowledge to organize constraints
[AD-A133417] N84-15838
Methods of the analysis of the disruption of tracking
[AD-A133335] N84-15963
TIME LAG
Time delay estimation using the adaptive delay element
[DE84-002042] N84-15403
TISSUES (BIOLOGY)
Bone blood flow measured by (41)Ar clearance formed by (44)Ca(n,(-)) (41)Ar
[DE83-017600] N84-15761
TITAN
Voyager observations of Saturn's rings. 1: The eccentric rings at 1.29, 1.45, 1.95 and 227 Rs N84-16087
TITANIUM
A melt for the electrolytic application of titanium plating
[BLL-OA-TRANS-3111-(6L96.3)] N84-15241
TITANIUM ALLOYS
Trichite growth during oxidation of titanium and TA6V4 alloy by water vapor at high temperatures
[NASA-TM-76974] N84-15248
TITANIUM NITRIDES
Comparative study of TiN hard coatings produced by reactive sputtering, ion-plating and CVD technique
[BLL-RARDE-TR-1094(7291.7965)] N84-15236
TOKAMAK DEVICES
Dissipation of magnetic energy during disruptive current termination — disruptions in tokamak reactors
[IPPJ-644] N84-15973
Preionization and start-up in the ISX-B Tokamak using electron cyclotron heating at 28 GHz
[DE84-002261] N84-15984
TOLERANCES (PHYSIOLOGY)
Effects of long-term low-level radiofrequency radiation exposure on rats. Volume 1: Design, facilities, and procedures
[AD-A134079] N84-15756
TOOLS
CADAS: A computer aided design tool for avionic systems N84-15065
Advantages of using diamond tools brazed under high vacuum
[CSIR-TRANS-1709] N84-15293
TOPOGRAPHY
The causation and variability of the northern winter quasi-stationary planetary waves N84-15705
Some effects of surface heating and topography on the regional severe storm environment N84-15723
TORNADOES
A numerical investigation of the formation of secondary vortices in laboratory-simulated tornadoes N84-15725
Relationships between thunderstorm mesoscale circulation and tornadogenesis N84-15727
TOROIDAL PLASMAS
Search for Hadron jets and large transverse momentum electrons at the SPS pp collider N84-15913
Dynamics of a high current electron ring in a conventional betatron accelerator
[AD-A133291] N84-15945
Radiation effects in the Joint European Torus Experiment: Guidelines for preliminary design
[R857/2] N84-15971
Nonlinear interaction of toroidicity induced drift modes
[DE84-001562] N84-15987
Sustained self-reversal in the reversed field pinch
[DE84-001559] N84-15990
TOROIDS
Dynamics of a high current electron ring in a conventional betatron accelerator
[AD-A133291] N84-15945

TORQUE
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169
Thermal conductance and torque of thin section four-point contact ball bearings in vacuum
[ESA-ESTL-54] N84-15562
TORSIONAL STRESS
Refined test methods in evaluating brittle material strengths
[AD-A133596] N84-15610
TOWERS
Establishment and discontinuance criteria for airport traffic control towers
[AD-A133461] N84-15141
TOXIC HAZARDS
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
TOXICITY
Acute intramuscular toxicity (LD50) of 1,1'-trimethylenebis (4-(Hydroxyiminomethyl) pyridinium bromide) monohydrate, (TMB-4) in male mice
[AD-A133148] N84-15758
TOXICOLOGY
Inhalation toxicology. 3: Evaluation of thermal degradation products from aircraft and automobile engine oils, aircraft hydraulic fluid, and mineral oil
[AD-A133221] N84-15778
TRACKING (POSITION)
Distributed sensor network
[AD-A133250] N84-15903
Methods of the analysis of the disruption of tracking
[AD-A133335] N84-15963
TRACKING NETWORKS
Distributed sensor network
[AD-A133250] N84-15903
TRACKING RADAR
A review of propagation and scattering factors in remote-sensing and ship-tracking by HF radar N84-15655
TRADEOFFS
Broad specification fuels combustion technology program
[NASA-CR-168179] N84-15283
TRAFFIC CONTROL
Dynamic control of session input rates in communication networks
[AD-A133572] N84-15379
TRAILING EDGES
Computational and experimental study of trailing vortices N84-15103
A model of the trailing edge separation on an airfoil
[AD-A126703] N84-15125
TRAINING ANALYSIS
Evaluation results for the interactive video competency recognition system
[AD-A133052] N84-15796
Computer based landing signal officer carrier aircraft recovery model
[AD-A133507] N84-15808
TRAJECTORIES
A study of the return to isotropy of homogeneous turbulence N84-15110
FOD (Foreign Object Damage) generation by aircraft tires — probability of engine ingestion and airfield surface movements
[AD-A133319] N84-15146
TRANSDUCERS
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
TRANSFER OF TRAINING
Evaluation of map symbols for a computer generated topographic display: Transfer of training, symbol confusion, and association value studies
[AD-A133590] N84-15643
TRANSFER ORBITS
Optimal low thrust, three burn orbit transfers with large plane changes N84-15166
Capture-ejector satellites
[NASA-TM-85686] N84-15179
TRANSFORMATIONS
Design and microprocessor-based implementation of digital frequency selective filters for application in terrain roughness identification
[AD-A133459] N84-15826
TRANSFORMATIONS (MATHEMATICS)
A representation for shape based on peaks and ridges in the difference of low-pass transform
[AD-A133299] N84-15849
TRANSFORMERS
Computation of the temperature distribution due to eddy-currents in the wall of a power transformer
[PB83-217273] N84-15410
TRANSIENT HEATING
Sodium boiling experiments in bundle geometries under fast transient and steady state conditions — fast breeder reactor safety analysis N84-15496
TRANSISTOR AMPLIFIERS
Considerations for choosing microwave transistors in high power shipboard search radars
[AD-A133279] N84-15367
TRANSISTORS
Considerations for choosing microwave transistors in high power shipboard search radars
[AD-A133279] N84-15367
TRANSITION METALS
The chemistry of transition metal carbene complexes
[AD-A133541] N84-15225
Oxygen adsorption and initial oxidation of single crystal first row transition metal and alloy surfaces N84-15316
Kinematics of the structure and morphology during surface reactions between transition metals and molecular hydrogen N84-15317
TRANSITION PROBABILITIES
Collisional-radiative model for helium-like ions: Application to intermediate-density plasmas
[IPPJ-647] N84-15976
TRANSITION TEMPERATURE
Synthesis and characterization of some thermotropic nematic and cholesteric polymers N84-15262
Relationship between the glass transition temperature and the chemical structure of polymers
[RAE-LIB-TRANS-2098] N84-15265
TRANSMISSION LINES
Bidirectional fiber optic cable adapter
[AD-A133371] N84-15370
TRANSMISSIVITY
Low X-ray absorption aneurism clips
[NASA-CASE-LAR-12650-2] N84-15764
TRANSMISSOMETERS
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1
[AD-A133587] N84-15380
TRANSMITTER RECEIVERS
The small transmitter receiver stations in the Sirio experiment — microwave transmission
[FUB-50-1982] N84-15386
A review of underwater acoustic systems and methods for locating objects lost at sea
[NASA-TM-85727] N84-15898
TRANSMITTERS
Considerations for choosing microwave transistors in high power shipboard search radars
[AD-A133279] N84-15367
Bidirectional fiber optic cable adapter
[AD-A133371] N84-15370
TRANSONIC COMPRESSORS
Flow mechanism and experimental investigation of a rotating stall in transonic compressors
[NASA-TM-77373] N84-15122
TRANSONIC FLIGHT
Computational procedures in transonic aerodynamic design
[NLR-MP-82020-U] N84-15131
TRANSONIC FLOW
Nonlinear Green's function method for transonic potential flow N84-15104
Effects of wall interference on unsteady transonic flows N84-15105
TAS: A Transonic Aircraft/Store flow field prediction code
[NASA-CR-3721] N84-15114
Inlet flow field investigation. Part 1: Transonic flow field survey
[NASA-CR-172239] N84-15123
Computations of projectile magnus effect at transonic velocities
[AD-A133212] N84-15127
Calculation of transonic flow around two wing-fuselage combinations using a full potential equation method
[FFA-137] N84-15132
Iterative solution of the finite difference potential equations for subsonic and transonic flows N84-15436
Explicit multistage finite volume procedure to solve the Euler equations for transonic flow N84-15464
Numerical computation of transonic flow governed by the full-potential equation N84-15469
Two dimensional condensing flow in transonic turbine cascades N84-15484
Unsteady pressure and force measurements associated with transonic buffeting of a two-dimensional supercritical airfoil
[AD-A133139] N84-15503
Explicit second order splitting schemes for solving hyperbolic nonlinear problems: Theory and application to transonic flow
[ESA-TT-768] N84-15855
Numerical modeling and fast-solver calculation of approximately normal shocks
[NLR-MP-82026-U] N84-15856
Some new developments in exact integral equation formulations for sub- or transonic potential flow
[NLR-MP-82024-U] N84-15860
Acoustic shocks in a variable area duct containing near sonic flows
[NASA-CR-172274] N84-15897
Transonic noise generation by duct and profile flow
[AD-A129367] N84-15899
TRANSONIC WIND TUNNELS
Three-dimensional effects on airfoils
[NASA-TM-77025] N84-15118
A quasi-continuous transonic wind tunnel for cryogenic operation
[ROLLAB-MEMO-RM-096] N84-15161
TRANSPONDERS
Video processor for air traffic control beacon system
[NASA-CASE-KSC-11155-1] N84-15395
TRANSPORT AIRCRAFT
Two decades of air carrier jet operation N84-15080
TRANSPORT THEORY
Nonlinear interaction of toroidicity induced drift modes
[DE84-001562] N84-15987
TRANSVERSE OSCILLATION
Triggering at high luminosity: Fake triggers from pile-up N84-15932
TRAPPED PARTICLES
Nonlinear interaction of toroidicity induced drift modes
[DE84-001562] N84-15987
TRAVELING WAVE TUBES
Performance of computer-designed small-size multistage depressed collectors for a high-perveance traveling wave tube
[NASA-TP-2248] N84-15394
TRIBOLOGY
Thermal conductance and torque of thin section four-point contact ball bearings in vacuum
[ESA-ESTL-54] N84-15562
Activities report of the European Space Tribology Laboratory (ESTL)
[ESA-ESTL-55] N84-15563
TRIGGER CIRCUITS
Trigger systems which could operate at a luminosity of 10/sup 33 cm(-2) to sec/sup -1 N84-15918
Searching for limitations in capability due to high average rates N84-15919
Triggering at high luminosity: Fake triggers from pile-up N84-15932
Fast asynchronous level 1 pre-trigger for electrons at L = 10/sup 33 cm-2 sec-1 N84-15933
Muons and electrons in general N84-15938
TROPICAL METEOROLOGY
Tropical cyclone operational plan for the Southwest Indian Ocean
[WMO-618] N84-15741
TROPICAL STORMS
Some effects of surface heating and topography on the regional severe storm environment N84-15723
Tropical cyclone operational plan for the Southwest Indian Ocean
[WMO-618] N84-15741
TROPOSPHERE
Middle latitude forcing of a model tropical atmosphere with horizontally nonuniform basic states N84-15724
Evaluation of 2 1-D cloud models for the analysis of VAS soundings
[NASA-CR-3771] N84-15729
TRUCKS
1981 CRC (Coordinating Research Council) diesel fuel low-temperature operability field test
[AD-A133543] N84-15289
TUBE HEAT EXCHANGERS
Steam condenser developments N84-15488
TUNING
Maser cavity servo-tuning system
[NASA-CASE-NPO-15890-1] N84-15536
TURBINE BLADES
Low-cost single-crystal turbine blades, volume 1
[NASA-CR-168218] N84-15247
General method for fatigue analysis of vertical axis wind turbine blades
[DE84-002654] N84-15613
Aeroelastic analysis of a Darrieus type wind turbine blade with troposkien geometry N84-15623
Scaling wind characteristics for designing small and large wind turbines
[DE83-014501] N84-15728
TURBINE ENGINES
Aerothermal modeling. Executive summary
[NASA-CR-168330] N84-15152
TURBINE PUMPS
Linear and nonlinear aspects of rotordynamics N84-16034

TURBINE WHEELS
Experimental determination of gap flow-conditioned forces at turbine stages and their effect on the running stability of simple rotors
[NASA-TM-77293] N84-15553
TURBOCOMPRESSORS
Experimental methods in compressor noise studies --- jet engine tone noise N84-15028
Aerodynamics and steam wetness fraction of a multistage turbine. Comparison of prediction with experimental data N84-15475
Design procedures for compressor blades
[NASA-TM-77085] N84-15552
TURBOFAN ENGINES
Study of noise-certification standards for aircraft engines. Volume 2: Procedures for measuring far field sound pressure levels around an outdoor jet-engine test stand
[AD-A133408] N84-15158
TURBOJET ENGINES
Experimental methods in compressor noise studies --- jet engine tone noise N84-15028
TURBOMACHINERY
A miniature tilting pad gas lubricated bearing N84-15340
Three-dimensional turbulent boundary layers in turbomachines N84-15460
TURBOPROP ENGINES
Fuel economy in aviation
[NASA-SP-462] N84-15144
TURBULENCE
Some comments on the hazards associated with manoeuvring flight in severe turbulence at high speed and low altitude N84-15089
A study of the return to isotropy of homogeneous turbulence N84-15110
Bifurcations in nonlinear problems of hydrodynamic instability of plane parallel shear flows N84-15411
Studies in unsteady penetrative thermal convection N84-15422
TURBULENT BOUNDARY LAYER
Asymptotic theory of an unseparated supersonic turbulent boundary layer at a compression corner N84-15112
A model of the trailing edge separation on an airfoil
[AD-A126703] N84-15125
Experimental mixed convection heat transfer from a large vertical surface in a horizontal flow N84-15412
A finite difference technique for laminar and turbulent compressible boundary layers N84-15433
Turbulent shear flows --- conferences
[VKI-LS-1983-03] N84-15448
Large scale motion in turbulent boundary layers N84-15455
Some aspects of two-dimensional compressible turbulent boundary layers N84-15456
Effects of unsteadiness on turbulent boundary layers N84-15457
Three-dimensional turbulent boundary layers N84-15459
Three-dimensional turbulent boundary layers in turbomachines N84-15460
Three-dimensional, time-dependent, compressible, turbulent, integral boundary-layer equations in general curvilinear coordinates and their numerical solution
[AD-A133289] N84-15504
Cavitation inception observations on axisymmetric headforms with turbulence stimulators
[AD-A133517] N84-15506
Some notes on 3-dimensional turbulent boundary layer data and turbulence modeling
[NLR-MP-82007-U] N84-15513
Instability and transition in the boundary layer N84-15516
TURBULENT FLOW
Generation of sound in turbulent shear flows N84-15031
Numerical simulation of separated flows N84-15413
An experimental investigation of the structure of a turbulent reattaching flow behind a backward-facing step N84-15415
The structure of turbulent entraining flow in an annulus with a rotating screen N84-15416
Design, construction, and use of a high-resolution, two-component LDA N84-15419
Turbulent shear flows --- conferences
[VKI-LS-1983-03] N84-15448
Introduction to turbulent shear flows N84-15449
Experimental techniques for free edges of turbulent flows N84-15450
Asymmetric turbulent flows N84-15451
The core region of channel flows N84-15452
Eddy detection within turbulent shear flows N84-15453
The bursting phenomenon in bounded shear flows N84-15454
Large scale motion in turbulent boundary layers N84-15455
Effects of unsteadiness on turbulent boundary layers N84-15457
Computation of turbulent gas-particle suspension flows in channels N84-15470
Some notes on 3-dimensional turbulent boundary layer data and turbulence modeling
[NLR-MP-82007-U] N84-15513
Improved turbulence models based on large eddy simulation of homogeneous, incompressible turbulent flows N84-15514
Scaling wind characteristics for designing small and large wind turbines
[DE83-014501] N84-15728
TURBULENT HEAT TRANSFER
Turbulence modeling in liquid metal free convection --- in reactor cooling systems N84-15490
Turbulent heating in solar cosmic ray theory
[NASA-85074] N84-16108
TURBULENT JETS
Fully-coupled analysis of jet mixing problems. Part 1. Shock-capturing model, SCIPVIS
[NASA-CR-3761] N84-15425
TURBULENT MIXING
Flow visualization and LDV measurement of turbulent mixing layers
[REPT-606] N84-15424
Fully-coupled analysis of jet mixing problems. Part 1. Shock-capturing model, SCIPVIS
[NASA-CR-3761] N84-15425
TURBULENT WAKES
Three-dimensional wake of a swept wing N84-15458
TWISTING
A study of accretion in compact sources: Disk precession and jet helicity N84-16038
TWO DIMENSIONAL BOUNDARY LAYER
Some aspects of two-dimensional compressible turbulent boundary layers N84-15456
TWO DIMENSIONAL FLOW
Flow mechanism and experimental investigation of a rotating stall in transonic compressors
[NASA-TM-77373] N84-15122
Ice formation in aircraft N84-15130
Numerical simulation of separated flows N84-15413
Some aspects of two-dimensional compressible turbulent boundary layers N84-15456
Two dimensional condensing flow in transonic turbine cascades N84-15484
Fully coupled calculation of fluid flows with limited use of computer storage
[DE84-002218] N84-15508
TWO PHASE FLOW
Computation of turbulent gas-particle suspension flows in channels N84-15470
The BLOW-3A: A theoretical model to describe transient two phase flow conditions in Liquid Metal Fast Breeder Reactor (LMFBR) coolant channels N84-15497
Two-phase flow studies
[DE84-001727] N84-15511
Direct steam generation in line-focus solar collectors
[DE83-006030] N84-15678

U

ULTRAHIGH FREQUENCIES
Engineering evaluations and studies. Volume 2: Exhibit B, part 1
[NASA-CR-171725] N84-15175
A digital ferrite phase-shifter for high power S-band operation N84-15886
ULTRALOW TEMPERATURES
Structural studies at elevated pressure and reduced temperatures using synchrotron radiation: Application to Ce.8La.1Th.1
[DE84-001793] N84-16007
ULTRASONIC FLAW DETECTION
The use of microprocessors for the instrumentation of nondestructive tests
[CISE-2072] N84-15571
The use of matrix transducers in medium thickness welding inspection
[CISE-2075] N84-15572
ULTRASONIC TESTS
Ultrasonic test data acquisition and defect verification of stainless steel welds at 4000 deg F
[DE83-012146] N84-15570
ULTRASONICS
Input-output characterization of an ultrasonic testing system by digital signal analysis
[NASA-CR-3756] N84-15565
ULTRAVIOLET LASERS
Development of an XUV amplifier N84-15532
ULTRAVIOLET RADIATION
High resolution ultraviolet laser spectroscopy of mercury and helium N84-15214
Effect of UV illumination on the sublimation of basal surfaces of zinc oxide
[AD-A133383] N84-15222
Atomic oxygen effects on materials N84-16036
Optical and X-ray selected samples of quasars: Evolution of the luminosity distributions N84-16090
ULTRAVIOLET SPECTRA
FGGE/SBUV tape specification and shipping letter description
[NASA-CR-170482] N84-16071
ULTRAVIOLET SPECTROMETERS
Voyager observations of Saturn's rings. 1: The eccentric rings at 1.29, 1.45, 1.95 and 227 Rs N84-16087
ULTRAVIOLET TELESCOPES
Fine pointing control of the solar UV telescope on the sounding rocket S-520-5
[ISAS-608] N84-16094
UNDERGROUND EXPLOSIONS
Surface wave path corrections, deterministic discrimination and body wave attenuation
[AD-A133574] N84-15714
UNDERWATER ACOUSTICS
Program in marine physics applied to Navy undersea missions
[AD-A133119] N84-15753
A review of underwater acoustic systems and methods for locating objects lost at sea
[NASA-TM-85727] N84-15898
The numerical synthesis and inversion of acoustic fields using the Hankel transform with application to the estimation of the plane wave reflection coefficient of the ocean bottom
[AD-A133156] N84-15901
Marine environmental acoustics
[AD-A133245] N84-15902
UNIDENTIFIED FLYING OBJECTS
First UFO incident for our country
[AD-A133326] N84-16058
UNIFIED FIELD THEORY
Future search for grand unified theory magnetic monopoles
[DE83-009451] N84-16015
UNITED KINGDOM
Proceedings of the 3rd Tripartite Conference on Submarine Medicine: France, United Kingdom and the United States
[AD-A133150] N84-15777
UNITED STATES OF AMERICA
Census of US Civil aircraft. Calendar year 1982
[AD-A133161] N84-15033
UNIVERSITY PROGRAM
Research reports: 1983 NASA/ASEE Summer Faculty Fellowship Program
[NASA-CR-170942] N84-16022
UNSTEADY FLOW
Effects of wall interference on unsteady transonic flows N84-15105
An assumed deviatoric stress-velocity-pressure mixed finite element method for unsteady convective, incompressible viscous flow N84-15420
Unsteady pressure and force measurements associated with transonic buffeting of a two-dimensional supercritical airfoil
[AD-A133139] N84-15503
UPWELLING WATER
The nature of microwave backscattering from water waves N84-15665
The advection of submesoscale thermal features in the Alboran Sea Gyre
[AD-A133877] N84-15749
URANIUM
Uranium anomalies in Wyoming and parts of adjacent states. National Uranium Resource Evaluation
[DE83-005353] N84-15638
Superconducting ground state of a strongly interacting electron system: UBe13
[DE84-001708] N84-16003
URETHANES
Partial analysis of Insta-Foam N84-16030
USER MANUALS (COMPUTER PROGRAMS)
User's manual for GAMNAS: Geometric and Material Nonlinear Analysis of Structures
[NASA-TM-85734] N84-15200
Computer-Aided Structural Engineering (CASE) project. User's guide: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133600] N84-15611
An interactive soils information system. Users manual
[AD-A133480] N84-16078
USER REQUIREMENTS
Towards a modularity of software conceived for the requirement of the user N84-15040

The creation of the NLR benchmark package and the performance of two new CDC computers with it
[NLR-MP-82015-U] N84-15819
Local automation model: Functional description
[AD-A133389] N84-16077

V

VACUUM
Observations on the vanadium-nitrogen system and on pure metallic vanadium
[CSIR-TRANS-1708] N84-15243
Progress in polycrystalline thin-film solar cells
[DE83-012131] N84-15691
VACUUM APPARATUS
Optical multiple sample vacuum integrating sphere
[NASA-CASE-GSC-12849-1] N84-15960
VACUUM SYSTEMS
Fabrication of a hermetically sealed connector
[DE84-002322] N84-15402
Improved four-stage accel-decel production of low-energy stripped heavy ions
[DE83-005791] N84-15908
VALVES
Compact Claude cycle refrigerator for laboratory use N84-15338
VAN DE GRAAFF ACCELERATORS
Improved four-stage accel-decel production of low-energy stripped heavy ions
[DE83-005791] N84-15908
VANADIUM
Observations on the vanadium-nitrogen system and on pure metallic vanadium
[CSIR-TRANS-1708] N84-15243
VAPOR DEPOSITION
Chemical vapor deposition of group IVB, VB, and VIB elements with nonmetals. A literature review
[PB83-225409] N84-15228
Comparative study of TiN hard coatings produced by reactive sputtering, ion-plating and CVD technique
[BLL-RARDE-TR-1094(7291.7965)] N84-15236
VAPOR PHASE EPITAXY
AlGaAsSb vapor phase epitaxy and laser program
[AD-A133123] N84-15995
Control of impurities in the epitaxial growth of high quality GaAs
[AD-A133187] N84-15996
VAPORS
Propulsion apparatus and method using boil-off gas from a cryogenic liquid --- controlling spacecraft attitude and drag
[NASA-CASE-MFS-25946-1] N84-15183
VARIABILITY
F-region variability and HF-propagation N84-15658
Studies of highly variable galactic X-ray sources with HEAO-1
[NASA-CR-170941] N84-16112
VARIANCE (STATISTICS)
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
VARIATIONS
Line profile variability in winds of OB stars N84-16085
VECTOR ANALYSIS
Population control of self-replicating systems: Option C N84-16044
VECTOR SPACES
Vector coding the finite volume procedure for the CYBER 205 N84-15465
VECTORS (MATHEMATICS)
Population control of self-replicating systems: Option C N84-16044
VELOCITY
XCP measurements off California in October 1982: Cruise report and preliminary results
[AD-A133051] N84-15754
VELOCITY DISTRIBUTION
Design procedures for compressor blades
[NASA-TM-77085] N84-15552
VELOCITY MEASUREMENT
Flow improvements in the circuit of the Langley 4- by 7-meter tunnel
[NASA-TM-85662] N84-15117
The Norwegian Seismic Array (NORSAR). Phase 3
[AD-A134038] N84-15713
VENTILATION
Variable inhibition by falling CO2 of hypoxic ventilatory response in man
[AD-A130658] N84-15768
VENUS (PLANET)
Transport processes in planetary atmospheres N84-16104
VENUS ATMOSPHERE
Thermal tides in the atmosphere of Venus N84-15702
Some issues related to evolution of planetary atmospheres N84-16103
VERY HIGH FREQUENCIES
Broadband base isolated asymmetrically fed VHF antenna N84-15393
VERY LONG BASE INTERFEROMETRY
Mission definition study for a VLBI station utilizing the Space Shuttle
[NASA-CR-175126] N84-15173
VERY LOW FREQUENCIES
Theoretical predictions for VLF radio propagation
[AD-A133168] N84-15364
VIBRATION
Engineering evaluations and studies. Volume 3: Exhibit C
[NASA-CR-171727] N84-15177
A NASTRAN DMAP procedure for calculation of base excitation modal participation factors N84-15599
Tube vibration in industrial-size test heat exchanger (90 deg square layout)
[DE83-011931] N84-15614
Linear and nonlinear aspects of rotordynamics N84-16034
VIBRATION DAMPING
Study on damping representation related to spacecraft structural design
[EMSB-18/83] N84-15182
Experimental determination of gap flow-conditioned forces at turbine stages and their effect on the running stability of simple rotors
[NASA-TM-77293] N84-15553
VIBRATION EFFECTS
Vibration-induced flux variation in the space between two concentric tubes
[BLL-CE-TRANS-7949-(9022.09)] N84-15583
The parabolic approximation for sound propagation in stratified moving media N84-15893
VIBRATION ISOLATORS
Evaluation of type 2 fast packs for electrostatic discharge properties
[AD-A133158] N84-15557
VIDEO DATA
Low rate transmission of video signals using adaptive delta modulation
[AD-A133145] N84-15363
VIDEO EQUIPMENT
A video bus for weapon system integration N84-15051
VIDICONS
Nanosecond image-shuttering studies at Los Alamos National Laboratory
[DE84-001733] N84-15405
VINYL POLYMERS
Ultrahigh molecular weight aromatic siloxane polymers N84-16042
VISCOELASTIC DAMPING
Study on damping representation related to spacecraft structural design
[EMSB-18/83] N84-15182
VISCOELASTICITY
Nonlinear viscoelastic characterization of structural adhesives
[NASA-CR-172279] N84-15268
Finite element and boundary element analysis of large strain large displacement problems in elastoplasticity N84-15580
The dynamic response characteristics of a viscoelastic beam on periodically-spaced, viscoelastic supports N84-15619
VISCOPLASTICITY
Finite element and boundary element analysis of large strain large displacement problems in elastoplasticity N84-15580
VISCOSITY
Wave propagation in porous rock and models for crustal structure N84-15698
VISCOUS FLOW
An assumed deviatoric stress-velocity-pressure mixed finite element method for unsteady convective, incompressible viscous flow N84-15420
VISIBLE INFRARED SPIN SCAN RADIOMETER
Evaluation of 2 1-D cloud models for the analysis of VAS soundings
[NASA-CR-3771] N84-15729
VISIBLE SPECTRUM
Development of visible/infrared/microwave agriculture classification and biomass estimation algorithms, volume 2 --- Oklahoma and Texas
[E84-10059] N84-15629
VISION
Basic vision events
[AD-A132746] N84-15782
Primary events in vision - investigation of basic eye responses
[AD-A132747] N84-15783
Spatial localization in strabismic observers
[AD-A132748] N84-15784
VISUAL PERCEPTION
Perception of higher derivatives of visual motion
[AD-A133908] N84-15773
Optical flow and texture variables useful in simulating self motion (2)
[AD-A133597] N84-15779
Basic vision events
[AD-A132746] N84-15782
Primary events in vision - investigation of basic eye responses
[AD-A132747] N84-15783
Spatial localization in strabismic observers
[AD-A132748] N84-15784
Human visual information processing: Basic viewpoints from psychology and human engineering research
[NLR-MP-82032-U] N84-15798
VISUAL STIMULI
Spatiotemporal characteristics of visual localization
[AD-A133952] N84-15770
Optical flow and texture variables useful in simulating self motion (2)
[AD-A133597] N84-15779
VISUAL TASKS
Human visual information processing: Basic viewpoints from psychology and human engineering research
[NLR-MP-82032-U] N84-15798
VOICE COMMUNICATION
Linguistic methodology for the analysis of aviation accidents
[NASA-CR-3741] N84-15135
Efficient utilization of the DRAMA service channel
[AD-A133286] N84-15368
Dynamic control of session input rates in communication networks
[AD-A133572] N84-15379
The satellite applications of amplitude companded single sideband modulation N84-15391
VOICE CONTROL
The satellite applications of amplitude companded single sideband modulation N84-15391
VOICE DATA PROCESSING
Increased aircraft survivability using direct voice input N84-15100
VOLCANOES
Theoretical and empirical terrestrial heat flow studies N84-15696
VORTEX ALLEVIATION
Helicopter blade tips
[NASA-TM-77370] N84-15119
VORTEX GENERATORS
A numerical investigation of the multiple vortex phenomenon: Vortex number and structure as a function of swirl ratio N84-16049
VORTICES
Computational and experimental study of trailing vortices N84-15103
An experimental investigation of the structure of a turbulent reattaching flow behind a backward-facing step N84-15415
Eddy detection within turbulent shear flows N84-15453
The bursting phenomenon in bounded shear flows N84-15454
Improved turbulence models based on large eddy simulation of homogeneous, incompressible turbulent flows N84-15514
A numerical investigation of the formation of secondary vortices in laboratory-simulated tornadoes N84-15725
A comparison study of the energetics of standing and transient eddies between two general circulation models: The GLAS Climate Model and the NCAR Community Climate Model N84-15726
Transonic noise generation by duct and profile flow
[AD-A129367] N84-15899
A numerical investigation of the multiple vortex phenomenon: Vortex number and structure as a function of swirl ratio N84-16049
VORTICITY
Relationships between thunderstorm mesoscale circulation and tornadogenesis N84-15727
Development and perturbation analysis of model stochastic equations for global circulation N84-15743
VOYAGER PROJECT
JPL closeup
[NASA-CR-175324] N84-15168
Voyager observations of Saturn's rings. 1: The eccentric rings at 1.29, 1.45, 1.95 and 227 Rs N84-16087

W

WAFERS
Integrated circuit failure mechanism detected by IMMA N84-15305
The concept of a solid state direct chamber N84-15924
WAKEFULNESS
Sleep and wakefulness handbook for flight medical officers
[AGARD-AG-270(FR)] N84-15788
WAKES
Wake characteristics and interactions of the Canard/wing lifting surface configuration of the X-29 forward-swept wing flight demonstrator
[AD-A133188] N84-15126
WALL FLOW
Effects of wall interference on unsteady transonic flows N84-15105
Three-dimensional effects on airfoils
[NASA-TM-77025] N84-15118
Asymmetric turbulent flows N84-15451
WARNING SYSTEMS
Performance characteristics of passive coherence estimators
[AD-A133209] N84-15396
Tropical cyclone operational plan for the Southwest Indian Ocean
[WMO-618] N84-15741
WASTE ENERGY UTILIZATION
LaNi5 hydride cryogenic refrigerator test results N84-15350
WASTE UTILIZATION
Gasogen for automobile use
[DE84-000712] N84-15291
WATER
Development of quantitative infrared analysis for monitoring water and emulsifying agents in fire-resistant microemulsion diesel fuels
[AD-A133242] N84-15286
WATER DEPTH
Results from wind tunnel and artificial rainfall tests of the modified scan sensor
[AD-A133238] N84-15162
WATER QUALITY
Use of LANDSAT MSS (multispectral scanner) digital data in water quality mapping of the Neuse River estuary, North Carolina
[PB83-256750] N84-15645
A preliminary survey of plankton and periphyton in the Turn Barge Canal and basin area of Kennedy Space Center, Florida N84-16027
WATER RESOURCES
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15651
WATER TEMPERATURE
Expendable bathythermograph (XBT) measurements in the Western Alboran Sea, October 1982
[AD-A133939] N84-15748
WATER TUNNEL TESTS
Cavitation inception observations on axisymmetric headforms with turbulence stimulators
[AD-A133517] N84-15506
WATER VAPOR
Trichite growth during oxidation of titanium and TA6V4 alloy by water vapor at high temperatures
[NASA-TM-76974] N84-15248
WAVE AMPLIFICATION
Microwave tubes: Literature survey number 4, comprising the year 1982
[FOA-C-30331-E] N84-15407
WAVE ATTENUATION
Surface wave path corrections, deterministic discrimination and body wave attenuation
[AD-A133574] N84-15714
WAVE DIFFRACTION
Diffraction of a plane electromagnetic wave by an elliptic cylinder: The multi-origin technique
[PB83-166769] N84-15390
Acoustic diffraction by an impedance-covered edge
[AD-A133266] N84-15904
WAVE FRONT RECONSTRUCTION
Estimate of blast wave properties --- unconfined vapor cloud explosions (UVCE) N84-15443
WAVE FRONTS
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
WAVE GENERATION
Microwave tubes: Literature survey number 4, comprising the year 1982
[FOA-C-30331-E] N84-15407
WAVE PROPAGATION
Nonlinear acoustics instabilities in combustion chambers N84-15230
Asymptotic analysis of numerical wave propagation in finite difference equations
[NASA-CR-175323] N84-15360
Coherent electromagnetic wave propagation and scattering in random media
[AD-A133601] N84-15381
Propagating plane harmonic waves through finite length plates of variable thickness using finite element techniques N84-15601
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602
A review of propagation and scattering factors in remote-sensing and ship-tracking by HF radar N84-15655
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
The effect of turbulent atmosphere on backscattered waves N84-15664
Wave propagation in porous rock and models for crustal structure N84-15698
A numerical investigation of the formation of secondary vortices in laboratory-simulated tornadoes N84-15725
Two stochastic modeling problems in communications and navigation
[AD-A133458] N84-15873
A study of accretion in compact sources: Disk precession and jet helicity N84-16038
WAVE REFLECTION
Reflection and transmission of electromagnetic waves at a rough interface between two different media
[PB83-217568] N84-15389
WAVEFORMS
Interpretation of near-source ground motion and implications N84-15697
WAVEGUIDE LASERS
A low loss quasioptical cavity for a two-stage Free Electron Laser (FEL)
[AD-A133321] N84-15541
WAVELENGTHS
Scintillators and waveshifters for fast scintillator-WSB calorimetry N84-15929
WEAPON SYSTEMS
Advanced Concepts for Avionics/Weapon System Design, Development and Integration
[AGARD-CP-343] N84-15034
System architecture: Key to future avionics capabilities N84-15035
Tactical requirements impact on avionics/weapon system design N84-15036
Operational readiness and its impact on fighter avionics system design N84-15037
Avionics concept evaluation at the force level N84-15038
Avionics/crew station integration N84-15042
Guidelines and criteria for the functional integration of avionic systems with crew members in command N84-15044
Navy's advanced aircraft armament system program concept objectives N84-15045
Advanced F/A-18 avionics N84-15048
A video bus for weapon system integration N84-15051
First level integrated maintenance in weapons systems N84-15054
Critical factors and operational research in tactical fighter avionic system development N84-15062
Concept of a fighter aircraft weapon delivery system N84-15064
Design and verification of electromagnetic compatibility in airborne weapons systems N84-15066
Methods for developing the navigation and weapon systems of the Mirage 2000 N84-15068
Concepts for avionic and weapon integration facilities N84-15070
Hardware-in-the-loop simulation techniques used in the development of the Sea Harrier avionic system N84-15071
Simulation requirements to support the development of a fault tolerant avionic system N84-15072
WEAPONS DELIVERY
Tactical requirements impact on avionics/weapon system design N84-15036
The lock-on-before-launch weapon delivery and display/control consideration N84-15056
Computer aided construction of ground attack mission profiles over European terrain N84-15060
AFTI/F-16: An integrated system approach to combat automation N84-15063
Concept of a fighter aircraft weapon delivery system N84-15064
Hardware-in-the-loop simulation techniques used in the development of the Sea Harrier avionic system N84-15071
WEAR
The influence of surface roughness on the transfer and wear of polymers
[AD-A133527] N84-15275
A miniature tilting pad gas lubricated bearing N84-15340
WEAR INHIBITORS
The influence of surface roughness on the transfer and wear of polymers
[AD-A133527] N84-15275
WEATHER FORECASTING
Tropical cyclone operational plan for the Southwest Indian Ocean
[WMO-618] N84-15741
WEATHERING
The effect of environment on the mechanical behavior of AS/3501-6 graphite/epoxy material
[AD-A133331] N84-15205
WELD TESTS
Embrittlement of steels due to galvanizing or coating with zinc paint: An investigation of embrittlement in welding or heating operations --- liquid metal embrittlement
[AERE-TR-4774] N84-15244
The use of matrix transducers in medium thickness welding inspection
[CISE-2075] N84-15572
WELDED JOINTS
Corrosion of TIG welded austenitic stainless steels
[BLL-WINDSCALE-TR-959-(9091.F)] N84-15235
Ultrasonic test data acquisition and defect verification of stainless steel welds at 4000 deg F
[DE83-012146] N84-15570
Miniature center-cracked-tension specimen for fatigue crack growth testing
[DE84-001470] N84-15615
WELDING
Investigations on the reproducibility of the results of drop weight tests by the method of W. S. Pellini
[BLL-DRIC-T-6970-(3623.66)] N84-15517
Welding deformations and residual stresses due to circumferential welding of cylindrical shells and hemispherical end plates
[BLL-DRIC-T-6968-(3623.66)] N84-15549
Influence of Ar + CO2 shielding on the composition of a Cr-Mo-V weld
[BLL-CE-TRANS-8000-(9022.09)] N84-15550
WELDING MACHINES
Sensor control of robot arc welding N84-16047
WHISKER COMPOSITES
Production and characterization of beta-silicon carbide and alpha-silicon nitride whiskers for ceramic matrix composites
[LA-9650-MS] N84-15197
WIGGLER MAGNETS
Two-stage FEL (Free Electron Laser) program
[AD-A133508] N84-15546
WIND (METEOROLOGY)
Range reference atmosphere 0-30 km altitude, Eglin AFB, Florida
[AD-A133506] N84-15734
WIND EFFECTS
Wind tunnel tests on a model of a semisubmersible platform and comparison of the results with full-scale data
[NLR-MP-82014-U] N84-15113
WIND MEASUREMENT
Worldwide experience of wind shear during 1981-1982 N84-15087
WIND SHEAR
Worldwide experience of wind shear during 1981-1982 N84-15087
Influence of windshear on flight safety N84-15088
WIND TUNNEL DRIVES
A quasi-continuous transonic wind tunnel for cryogenic operation
[ROLLAB-MEMO-RM-096] N84-15161
WIND TUNNEL MODELS
Wind tunnel tests on a model of a semisubmersible platform and comparison of the results with full-scale data
[NLR-MP-82014-U] N84-15113
Wake characteristics and interactions of the Canard/wing lifting surface configuration of the X-29 forward-swept wing flight demonstrator
[AD-A133188] N84-15126
WIND TUNNEL STABILITY TESTS
Wind tunnel tests on a model of a semisubmersible platform and comparison of the results with full-scale data
[NLR-MP-82014-U] N84-15113
New investigation of short wings with lateral jets
[NASA-TM-77347] N84-15124
WIND TUNNEL TESTS
Effects of wall interference on unsteady transonic flows N84-15105

New, high performance rotating parachute --- reentry vehicle recovery
[DE84-002382] N84-15129
An experimental study of airfoil-spoiler aerodynamics N84-15133
Results from wind tunnel and artificial rainfall tests of the modified scan sensor
[AD-A133238] N84-15162
The SERI advanced and innovative wind energy concepts program
[DE83-011960] N84-15680

WIND TURBINES
Recent advances in variable speed electrical generator systems for large wind turbines
[DE84-001833] N84-15404
Aeroelastic analysis of a Darrieus type wind turbine blade with troposkien geometry N84-15623
Assessment of load-frequency-control impacts caused by small wind turbines
[DE82-011513] N84-15677
The SERI advanced and innovative wind energy concepts program
[DE83-011960] N84-15680
Scaling wind characteristics for designing small and large wind turbines
[DE83-014501] N84-15728

WIND VELOCITY
Worldwide experience of wind shear during 1981-1982 N84-15087
Alternative experiments using the geophysical fluid flow cell
[NASA-CR-3766] N84-15706

WINDOWS
Photodetachment neutralizer development. Laser-resonator study. Volume 1: Summary
[DE84-001682] N84-15547

WINDPOWER UTILIZATION
The SERI advanced and innovative wind energy concepts program
[DE83-011960] N84-15680

WING FLOW METHOD TESTS
New investigation of short wings with lateral jets
[NASA-TM-77347] N84-15124
Calculation of transonic flow around two wing-fuselage combinations using a full potential equation method
[FFA-137] N84-15132

WING TIP VORTICES
Helicopter blade tips
[NASA-TM-77370] N84-15119
Wake characteristics and interactions of the Canard/wing lifting surface configuration of the X-29 forward-swept wing flight demonstrator
[AD-A133188] N84-15126

WING TIPS
Analysis of nonplanar wing-tip mounted lifting surfaces on low-speed airplanes N84-15142

WINGS
A wing concept for supersonic maneuvering
[NASA-CR-3763] N84-15115

WINTER
A comparison of NMC models (1977) on precipitation forecasts for east coast cyclogenesis N84-15720

WIRE
Numerical electromagnetics code. Method of moments. User's guide supplement for NEC-3 for modeling buried wires
[DE84-002195] N84-15382
Integrated evaluation of the quality of steel cable wire
[BLL-M-35267-(5828.4)] N84-15564

WOOD
Gasogen for automobile use
[DE84-000712] N84-15291

WYOMING
Uranium anomalies in Wyoming and parts of adjacent states. National Uranium Resource Evaluation
[DE83-005353] N84-15638

X

X RAY ASTRONOMY
A mercuric detector system for X-ray astronomy. 2. Results from flight tests of a balloon borne instrument
[NASA-CR-175329] N84-16095
Development of a mercuric iodide solid state spectrometer for X-ray astronomy
[NASA-CR-175330] N84-16096

X RAY ASTROPHYSICS FACILITY
Preliminary designs for modifications to the X-ray source and beam monitor of the Marshall Space Flight Center's X-ray Calibration Facility N84-16032

X RAY DIFFRACTION
The polarization ratio of crystal monochromators
[AD-A133181] N84-15524

X RAY FLUORESCENCE
A new non-destructive and standardless method for the thickness determination of thin films by XRF measurement N84-15308

X RAY SCATTERING
Project objectives and progress at the Research Laboratory of Electronics
[RLE-125] N84-16016

X RAY SOURCES
Preliminary designs for modifications to the X-ray source and beam monitor of the Marshall Space Flight Center's X-ray Calibration Facility N84-16032
Studies of highly variable galactic X-ray sources with HEAO-1
[NASA-CR-170941] N84-16112

X RAYS
The polarization ratio of crystal monochromators
[AD-A133181] N84-15524
Decimetric gyrosynchrotron emission during a solar flare
[NASA-TM-85123] N84-16107
Theoretical calculation of rapid X-ray transients and radius expansion
[DE84-001312] N84-16114

Y

YIELD STRENGTH
Yield stress of type 21-6-9 stainless steel over a wide range of strain rate (10(-5) to 10-4 s(-1)) and temperature
[DE83-017159] N84-15259

Z

ZEEMAN EFFECT
Observation of magnetic fields in laser-produced plasma using the Zeeman effect
[DE84-002742] N84-15989

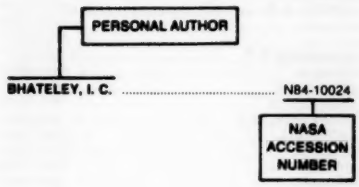
ZINC
Precipitation of metals from solutions by baser metals
[CSIR-1712] N84-15242

ZINC COATINGS
Embrittlement of steels due to galvanizing or coating with zinc paint: An investigation of embrittlement in welding or heating operations --- liquid metal embrittlement
[AERE-TR-4774] N84-15244

ZINC OXIDES
Effect of UV illumination on the sublimation of basal surfaces of zinc oxide
[AD-A133383] N84-15222

ZINC SULFIDES
Methodology for the objective validation of model performance, with an application to atmospheric transport models
[DE83-015693] N84-15693

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABBOTT, J. K. N84-15778
ABHYANKAR, R. B. N84-16069
ABSHIRE, J. B. N84-15674
ABUELFOUTOUH, N. M. N84-15581
ACCORNERO, A. N84-15475
ACKERMANN, R. A. N84-15343
ADAM, Y. N84-15432
ADELMAN, H. M. N84-15426
ADLER, R. J. N84-15946
AEBI, V. N84-16001
AEBY, I. N84-15405
AGARWAL, R. K. N84-16023
AGHINA, J. C. F. N84-15099
AGRAWAL, A. N84-15835
AGRAWAL, S. N84-15112
AHMAD, I. A. N84-15874
AHMED, N. N84-15406
AINSWORTH, O. R. N84-15880
AINSWORTH, R. N84-16024
AKITA, K. N84-16094
AKKERMANS, G. P. M. N84-15390
AL-KHAIAT, H. A. N84-15622
ALAM, J. N84-15573
ALBRECHCINSKI, T. M. N84-15162
ALEXANDER, J. K. N84-15766
N84-15768
ALEXANDER, S. S. N84-15628
N84-15631
ALI, A. W. N84-15538
ALITTI, B. N84-15922
ALLEN, B. N84-15640
ALLEN, B. P. N84-16063
ALLEN, H., JR. N84-15164
N84-16021
ALLEN, J. N84-16016
ANDERSEN, T. S. N84-15404
ANDERSON, A. B. N84-15292
ANDERSON, C. E. N84-15543
ANDERSON, D. L. N84-15710
ANDERSON, J. E. N84-15637
ANDERSON, J. R. N84-15638
ANDERSON, S. B. N84-15102
ANDERSON, V. C. N84-15753
N84-15902
ANDRIANOV, N. F. N84-15574
ANSARI, F. N84-15621
ANTAR, B. N. N84-16025
ANTOLOVICH, S. D. N84-15253
ANTONUCCI, R. R. J. N84-16069
APPEL, J. N84-15920
APPLIN, Z. T. N84-15117
ARDAI, J. N84-15640
ARETI, H. N84-15928
N84-15930
ARGOTE, L. N84-15805
ARINA, R. N84-15433
ARMSTRONG, B. N84-15910
ARONSON, S. N84-15919
N84-15935
ARVIND, ... N84-15937
ASARO, R. J. N84-15827
ASKEW, R. F. N84-15823
ATAC, M. N84-16026
N84-15916
ATENCIO, L. G. N84-15923
ATKIN, S. D. N84-15402
ATTALLA, A. N84-15254
ATTIA, F. G. N84-15227
AUPOIX, B. N84-15260
AUSTIN, R. W. N84-15458
AVANT, R. N84-15673
AWAD, E. A. N84-15796
AYDEMIR, A. Y. N84-15230
AYRES, D. N84-15990
N84-16015

B

BABA, Y. N84-15338
BABERNICS, L. N84-15217
BACHE, L. B. N84-15714
BAILEY, R. A. N84-15818
BALASCIO, J. F. N84-15998
BALESTRA, P. E. L. N84-15322
BALTAY, C. N84-15917
BANDY, S. N84-16001
BANNER, M. N84-15913
BANSAL, R. K. N84-15842
BAR-KANA, I. N84-15840
BARAN, R. H. N84-15374
BARBA, J. N84-15363
BARCLAY, J. A. N84-15351
BARDINA, J. N84-15514
BARISH, B. C. N84-15920
BARKER, J. L. N84-15634
BARLOW, R. E. N84-15835
BARNES, D. C. N84-15990
BARNES, G. D. N84-16027
BARNES, R. G. N84-16010
BARRETTE, J. N84-15908
BARTEL, W. N84-15916
BARTON, C. N. N84-15774
BASQUE, G. N84-15499
BASSON, J. H. N84-15304
BASTIDON, J. N84-15093
BATCHELOR, D. A. N84-16107
BATES, G. P. N84-15080
BATES, J. B. N84-16005
BATTAGLIA, F. N84-15193
BAUCOM, R. M. N84-15764
BAUDRY, T. V. N84-15593
BAUGHMAN, L. D. N84-15822
BAXTER, D. V. N84-15278
BAYNE, C. K. N84-15865
BEAUCHAMP, J. J. N84-15865
BECKER, F. N84-15899
BECKER, R. N84-15265
BECKETT, P. N84-15100
BECKMANN, P. N84-15306
BEITSCHER, S. N84-15297
BELMONT, H. H. N84-15160
BELSKY, L. E. N84-15735
BELT, G. S. N84-15506
BENENSON, G. N84-15939
BENHABIB, R. J. N84-15181
BENIGNUS, L. L. N84-15774
BENIGNUS, V. A. N84-15774
BENJAMIN, S. G. N84-15723
BENNETT, W. S., II N84-15063
BENNINGHOVEN, A. N84-15306
BENOCCI, C. N84-15490
BENSINGER, J. N84-15919
N84-15938
BENTLEY, C. R. N84-15627
BENZ, A. O. N84-16107
BERADI, L. N84-15062
BERARD, M. F. N84-15279
BERBERICH, J. J. N84-15767
BERGH, R. A. N84-15518
BERGIN, M. T. N84-15748
BERK, H. L. N84-15986
BERKOVITS, A. N84-15585
BERNING, G. L. P. N84-15319
BERNSTEIN, E. M. N84-15907
BERTOLINA, E. N84-15083
BERTSEKAS, D. N84-15379
BEST, P. N84-15796
BEZUIDENHOUT, F. N84-15319
BHARTIA, P. N84-15055
BHATE, S. K. N84-15343
BIEZEL, F. M. E. N84-15507
BIGGS, A. W. N84-15651
BILLINGS, D. S. N84-15769
BLACK, P. G. N84-15722
BLACKBURN, J. P. N84-15800
BLACKMON, J. B. N84-15676
BLACKWELDER, R. F. N84-15453
N84-15454
N84-15455
BLAIR, M. N84-15522
BLEKHER, P. M. N84-15981
BLESS, S. J. N84-15146
BLOOMFIELD, L. A. N84-15214
BLOUNT, D. H. N84-15183
BODWIN, G. T. N84-16018
BOECKING, K. N84-15056
BOERSTOEL, J. W. N84-15856
BOGDANOVICH, L. V. N84-15241
BOHLANDER, R. A. N84-15527
BOLT, B. A. N84-15716
BONCORPS, D. N84-15068
BOND, N. A., JR. N84-15797
BONDI, K. R. N84-15777
BONINO, R. N84-15922
BONORA, S. N84-15385
BOONSTRA, H. N84-15113
BOOYENS, H. N84-15304
BORDEN, G. J. N84-15808
BORGHESI, M. N84-15837
BOROUGHS, R. R. N84-15604
BOROWSKI, S. K. N84-15984
BORTNER, M. H. N84-15543
BOSTICK, W. N84-15946
BOTTA, E. F. F. N84-15862
BOTTONI, M. N84-15497
N84-15498
BOURNE, F. R. N84-15619
BOWMAN, R. C., JR. N84-15227
BOZEK, R. E. N84-15372
BRACHO, R. N84-15804
BRACKNELL, D. R. N84-15049
BRADLEY, P. A. N84-15656
BRAILE, L. W. N84-15708
BRAMLEY, E. N. N84-15656
BRANDES, E. A. N84-15727
BRANSON, J. N84-15920
BRAU, J. E. N84-15930
BRAUER, G. N84-15243
BRAUN, P. N84-15301
BRAUSER, K. N84-15097
BREIDENBACH, M. N84-15916
BREITHAUPT, R. D. N84-15259
BRETZ, P. E. N84-15251
BREWER, D. W. N84-15178
N84-15866
BREWER, J. A., III N84-15611
N84-15828
BRIDGMAN, M. S. N84-15150
BRINSON, H. F. N84-15268
BRINZA, V. N. N84-15895
BRISCOE, M. G. N84-15745
BRODSKY, S. J. N84-16018
BROECKER, F. W. N84-15044
BROECKER, W. S. N84-15739
BROGDEN, I. N84-15187
BRONNIKOVA, G. A. G. A. N84-15564
BROOKHART, M. S. N84-15225
BROOKS, D. E. N84-15755
BROOKS, W. N84-15353
BROSS, A. N84-15916
BROWN, M. T. N84-15344
BROWN, R. A. N84-16028
BROWN, S. T. N84-15683
BROWN, W. K. N84-15605
BROWN, W. S. N84-15165
BRUNDAGE, W. E. N84-16005

BRUNDIDGE, K. C. N84-16029
BUCCIARELLI, T. N84-15889
BUCH, A. N84-15585
BURATYNSKI, E. K. N84-15111
BURBECK, C. A. N84-15770
BURFORD, M. N84-15065
BURGER, J. A. N84-15638
BURKE, B. F. N84-15173
BURKE, G. J. N84-15382
BURKETT, S. D. N84-15810
BURNHAM, J. N84-15089
BURNSIDE, W. D. N84-15365
BURNYASHEV, I. I. N84-15584
BURROWS, L. T. N84-15090
BURRUS, D. L. N84-15152
N84-15155
N84-15156
BUSH, C. E. N84-15984
BUTERA, M. K. N84-15635
BUTLER, T. G. N84-15608
BUTNER, C. L. N84-15960
BUTTER, U. N84-15094
BUVET, R. N84-15276
BYRD, E. A. N84-15355
BYRNE, D. V. N84-15343
BYRNE, F. N84-15395

C

CAHN, R. N84-15920
CAHN, R. N. N84-15914
CAIGER, B. N84-15078
CALLAS, G. P. N84-15067
CALLAWAY, A. A. N84-15049
CALVO, E. J. N84-15681
CAMARASESCU, N. N84-15124
CAMILLERI, L. N84-15917
CAMPBELL, W. H. N84-15721
CAMPOS, P. E. N84-15790
CANADA, J. R. N84-15277
CANTER, K. F. N84-15953
CAPLOT, M. N84-15027
CARAFOLI, E. N84-15124
CAREY, D. A. N84-15222
CARITHERS, W. N84-15816
CARLSSON, E. N84-15644
CARLTON, C. N84-15287
CARPER, C. H. N84-15090
CARRERAS, E. A. N84-15979
CARROLL, R. N84-15920
CARROLL, R. J. N84-15868
CARROLL, T. N84-15918
CARTWRIGHT, M. N84-15038
CARY, J. R. N84-15985
CASE, W. R. N84-15599
CASTLE, K. R. N84-15633
CASTLES, S. N84-15352
CASTOR, J. I. N84-16102
CATEL, P. N84-15040
CATTARIN, G. N84-15886
CERTO, M. N84-15572
CHAEL, E. P. N84-15700
CHAIKIN, P. M. N84-16007
N84-16012
CHAMBERS, H. W. N84-15084
CHAN, C. K. N84-15348
CHAN, G. C. N84-15591
CHAN, J. Y. K. N84-15657
CHAN, K. W. S. N84-15264
CHAN, T. N84-15845
CHANDRA, A. N84-15580
CHANG, C. Y. N84-15919
N84-15936
CHANG, H. R. N84-15417
CHAU, L. L. N84-15939
CHAUVAT, P. N84-15922
CHEN, C. C. N84-15282
CHEN, P. C. T. N84-15607
CHEN, S. B. N84-15286
CHENG, U. N84-15174
N84-15175
N84-15176
N84-15177
CHEOK, K. C. N84-15826
CHERNIN, D. N84-15947
CHESHIRE, H. M. N84-15645
CHETVERIKOV, A. V. N84-15241
CHEVALLIER, J. P. N84-15118
CHIN, R. N84-15995
CHISHOLM, M. H. N84-15951
CHOI, K. S. N84-15110
CHOU, C. K. N84-15756
CHOU, L. W. N84-16030
CHRISTENSON, J. N84-15920
CHRISTIE, D. J. N84-15968
CIESLAK, W. R. N84-15258
CIMINO, J. B. N84-15648
CLAAR, T. D. N84-15679
CLARK, J. H. N84-15601
CLARK, M. N84-15907
CLARK, R. L. N84-15121
CLARK, S. K. N84-15587
CLARKE, F. J. N84-15219
CLARKE, J. N84-15669
CLARKE, J. F. N84-15218
CLINE, D. N84-16015
CLINE, P. A. N84-15900
CLINTON, R. G., JR. N84-16031
CLOUTMAN, L. D. N84-15561
CODDET, C. N84-15248
COFFEE, T. P. N84-15221
COLSON, W. B. N84-15544
COMINSKY, L. N84-16112
COMTE-BELLOT, G. N84-15450
N84-15451
N84-15452
CONETTI, S. N84-15928
N84-15930
CONNAN, C. N84-15046
CONNELL, J. R. N84-15728
CONRAD, E. R. N84-15059
CONTE, E. N84-15885
CONTURIE, Y. G. N84-15532
CONVEY, J. J. N84-15781
COOPER, J. C. N84-15961
COPE, R. N84-15065
CORAN, J. N84-15140
CORLE, R. R. N84-15297
CORNELL, C. A. N84-15712
CORNUEJOLS, G. N84-15852
CORREA, S. M. N84-15152
N84-15155
N84-15156
CORWIN, W. H. N84-15809
COSTIN, L. S. N84-15717
COTTER, S. J. N84-15693
COTTON, F. A. N84-15951
COUCH, W. P. N84-15204
COURTOIS, M. E. L. N84-15054
COUSINS, R. N84-15922
COUSTEIX, J. N84-15457
N84-15458
COWPER, G. R. N84-15136
COX, B. N84-15917
N84-15928
N84-15930
COX, G. F. N. N84-15609
COX, J. V. N84-15843
CRAFT, W. J. N84-15610
CRAIG, R. R., JR. N84-15521
N84-15522
CRANE, C. R. N84-15778
CRANE, R. M. N84-15204
CREUTZ, M. N84-15906
CRISTI, R. N84-15850
CROFT, W. L. N84-16032
CROOKE, M. N84-15305
CROSS, L. N84-15146
CROUSE, D. J. N84-16033
CROWLEY, J. L. N84-15849
CUNNINGHAM, P. E. N84-15393
CURRIER, P. L. N84-15051
CURRO, J. G. N84-15280
CURTICE, D. H. N84-15677
CURTIS, S. B. N84-15762
CUSMA, J. T. N84-15534
CYGAX, S. N84-15335

D

DADDIO, E. N84-15885
N84-15890
DALARD, F. N84-15238
DALBUONO, G. N84-15888
DALGARNO, A. N84-15711
DAME, R. E. N84-15687
DANEY, D. E. N84-15333
N84-15334
DANIELS, E. J. N84-15684
N84-15685
N84-15686
DARWISH, A. Y. N84-15586
DASARO, E. A. N84-15754
DASH, S. M. N84-15425
DATTAGURU, B. N84-15200
DAUGHERTY, T. L. N84-15556
DAVID, R. A. N84-15403
DAVIDSON, B. J. N84-15485
DAVIDTZ, J. C. N84-15325
DAVIS, J. A. N84-15061
DAWSON, L. R. N84-16006
DAY, W. B. N84-16034
DAYVAULT, R. D. N84-15638
DEANE, C. W. N84-16017
DEHMER, J. L. N84-15956
DEHMER, P. M. N84-15956
DEHOOP, A. T. N84-15389
DEJONG, P. N84-15878
DELHOTE, C. N84-15875
DELONEY, J. R. N84-15793
DELUCA, P. M., JR. N84-15761
DENERY, D. G. N84-15067
DENNING, D. N84-16080
DENTON, J. D. N84-15479
N84-15480
N84-15481
DEQUEIROZ, F. T. N84-15881
DERIN, H. N84-15850
DERRY, T. E. N84-15302
DESHAIES, B. N84-15445
DESHPANDE, M. D. N84-15555
DETCH, J. L. N84-15405
DEWIT, C. N84-15863
DEXTER, J. J. N84-15638
DIAMOND, P. H. N84-15987
DICK, E. N84-15435
N84-15436
DICK, R. J. N84-15372
DICKSON, R. E. N84-15638
DIEBOLD, B. N84-15920
DIEBOLD, R. N84-15940
DIGREGORIO, C. N84-15886
DINGUIRARD, M. N84-15529
N84-15633
DIXIT, S. N. N84-16014
DOBRY, R. N84-15712
DODDS, J. G. N84-15174
N84-15175
N84-15176
N84-15177
DODDS, R. H., JR. N84-15589
DODDS, W. J. N84-15151
N84-15283
DODGE, R. N. N84-15587
DOHERTY, M. P. N84-15982
DONAKOWSKI, T. D. N84-15684
N84-15685
N84-15686
DONATI, S. N84-15883
DOTTI, D. N84-15571
N84-15572
DOZIER, J. B. N84-16022
DRAPER, S. N84-15813
DRESSLER, M. N84-15363
DROEGE, R. E. N84-15767
DROEMER, D. W. N84-15989
DROLET, L. L. N84-15769
DROSTE, C. S. N84-15092
DRUMMOND, R. C. N84-15048
DRUZSBA, A. R. N84-15398
DUBOC, R. M., JR. N84-15356
DUDNEY, N. J. N84-16005
DUGGAN, T. O. N84-15299
DUGGIN, M. J. N84-15626
DUKE, J. C. N84-15206
DUKE, P. A. N84-15058
DUNEC, J. L. N84-15743
DUPLESSIS, J. N84-15319
DUQUETTE, D. J. N84-15258
DUTTA, J. M. N84-15966
DVORAK, G. J. N84-15198
DYCHES, G. M. N84-15810

E

EATON, M. N84-15917
EDELEN, R. B. N84-15641
EDELSACK, E. A. N84-15328
EDLING, G. N84-15235
EDMONDS, P. H. N84-15984
EDNERAL, N. V. N84-15234
EINHORN, H. J. N84-15872
EISS, N. S., JR. N84-15275
EKDAHL, C. A. N84-15946
EKSTEDT, E. E. N84-15151
N84-15283
ELACHI, C. N84-15648
ELAM, W. T. N84-16007
ELCHURI, V. N84-15153
N84-15154
N84-15597
N84-15598
ELDRED, C. H. N84-15179
ELDREDGE, D. N84-15150
ELDRIDGE, O. C. N84-15984

ELFES, A. N84-15802
ELGHADAMSI, F. E. N84-15620
ELIAS, G. N84-15032
ELLETT, J. N84-15922
ELLIOTT, D. B. N84-15632
ELLIOTT, G. R. N84-15406
ELLIOTT, H. N84-15850
ELLSAESSER, H. W. N84-15737
EMBURY, J. F. N84-15539
EMMITT, G. D. N84-15729
ENDECOTT, B. R. N84-15778
ENEVOLDSON, E. K. N84-15102
ENGELBRECHT, R. S. N84-15362
ENGLAND, A. C. N84-15984
ENGLAND, G. R. N84-15035
ENKE, C. G. N84-15815
ENNIS, D. J. N84-15353
ENTINE, G. N84-15994
ERICSON, T. N84-15879
ERIKSSON, L. E. N84-15463
N84-15464
ERMI, A. M. N84-15615
ERNST, H. B. N84-15765
ESSERS, J. A. N84-15433
N84-15446
N84-15470
ETHELL, J. L. N84-15144
ETTER, D. M. N84-15403
ETZKORN, H. W. N84-15314
EVANS, D. H. N84-15477
N84-15478
EVERSTINE, G. C. N84-15600
EYTH, J., JR. N84-15089
EZRA, C. E. N84-15633

F

FAILLA, C. C. N84-15559
FALCIASECCA, G. N84-15385
FAN, J. N84-15579
FANG, A. N84-15951
FARBER, N. N84-15876
FARINA, A. N84-15885
N84-15890
FARLEY, J. F. N84-15098
FARRELL, W. E. N84-15714
FEDI, F. N84-15387
FERGUSON, R. L. N84-15898
FERNHOLZ, H. H. N84-15456
FERRENBERG, A. N84-15284
N84-15428
FIELDS, D. E. N84-15693
FIFER, R. A. N84-15285
FILATOVS, G. J. N84-15610
FINOCCHIARO, G. N84-15917
FISCHLER, M. A. N84-15642
FISHER, M. J. N84-15029
N84-15030
FISK, Z. N84-16003
FLANAGAN, G. V. N84-15207
FLASHNER, H. K. N84-15181
FLESCH, T. R. N84-16035
FLORIO, U. G. N84-15884
FOGLER, R. J. N84-15406
FOHLEN, G. M. N84-15202
FOISY, P. N84-15239
FOLEY, J. N84-15735
FONSECA, G. F. N84-15801
FORD, H. N84-15877
FORT, A. N84-15101
FORTH, H. J. N84-15346
FOURNIER, M. N84-15666
FOX, M. S. N84-15814
N84-16063
FRANCIS, E. C. N84-15287
FRANKLIN, M. N84-15917
FRANZONI, U. N84-15320
FRASER, H. L. N84-15250
FREDERICK, F. A. N84-15523
FREEMAN, M. N84-16022
FRELLER, H. N84-15236
FRIEDMAN, M. N84-15566
FRITZ, I. J. N84-16006
FROMHOLD, A. T. N84-16036
FRUIN, J. T. N84-15758
FRULLONE, M. N84-15385
FUCHS, E. A. N84-15625
FUJII, M. N84-15247
FUJIMOTO, T. N84-15976
FUJITA, T. N84-15330
FUJITA, Y. N84-15549
FULLER, W. W. N84-16012

G

GAC, F. D. N84-15197
GAFNER, G. N84-15310
GAFNI, E. N84-15379
GAL, J. N84-15276
GALAN, R. N84-15096
GALLO, A. M. N84-15153
N84-15154
N84-15597
N84-15598
GAMACHE, R. R. N84-15659
GANGULI, G. N84-15948
GANS, R. F. N84-15427
GARAY, G. A. N84-16092
GARCIA, L. N84-15979
GARDNER, C. S. N84-15535
N84-15674
GARDNER, J. N84-15991
GARDNER, J. E. N84-15120
GARELIS, E. N84-15509
GARY, S. P. N84-15719
GASSER, M. G. N84-15327
GATTI, E. N84-15916
N84-15924
GAUTHIER, J. N84-15082
GEARHART, R. A. N84-15928
GEE, N. B. N84-15370
GEHRZ, R. D. N84-16098
GEIGER, W. N84-15440
N84-15442
GEMAN, D. N84-15850
GEORGE, R. L. N84-15728
GEORGE, T. F. N84-15193
N84-15942
GERLA, M. N84-15377
N84-15378
GERLACH, A. A. N84-15396
GERSTL, S. A. W. N84-15539
GHARIB, M. N84-15109
GHOSH, A. K. N84-15926
GIBSON, A. J. N84-15656
GIDAL, G. N84-15910
GIESEKKE, E. W. N84-15324
GILARDINI, A. N84-15883
GILCHRIESE, M. N84-15917
GILES, M. N84-15360
GJESSING, D. T. N84-15663
GLATZMAIER, G. A. N84-15718
GLOWINSKY, R. N84-15468
GOBBY, P. L. N84-15405
GODFREY, B. B. N84-15946
GOGUEN, J. A. N84-15135
GOLDBERG, M. N84-15919
N84-15934
N84-15937
GOLDOWSKY, M. N84-15345
GOLDSTEIN, M. E. N84-15031
GONZALEZ, R. R. N84-15780
GONZALEZ, V. H. N84-15650
GOODE, W. E. N84-16081
GOODKNIGHT, C. S. N84-15638
GOODMAN, J. M. N84-15661
GOODMAN, N. N84-15790
GOODMAN, P. S. N84-15805
GOODYKOONTZ, J. H. N84-15894
GORAN, W. D. N84-16078
GORDON, H. N84-15917
N84-15920
GOREE, J. G. N84-15196
GORETZKI, H. N84-15303
N84-15320
GOUDREAU, G. L. N84-15818
GOULD, R. W. N84-15136
GOUTELARD, C. N84-15652
N84-15653
GRADY, C. A. N84-16085
GRAHAM, W. G. N84-15907
GRAND, D. N84-15488
GRASDALEN, G. L. N84-16098
GRAY, W. H. N84-15593
GREEN, D. R. N84-15569
GREINER, D. N84-15916
GRIEFENDORF, D. N84-15306
GRIEM, H. R. N84-15989
GRIES, W. H. N84-15308
GRIFFIN, K. E. N84-15126
GRIGGS, M. N84-15671
GRIMES, A. G. N84-15297
GRISHIN, P. A. N84-15707
GRITTON, D. G. N84-15968
GROSGEBAUER, K. E. N84-15061
GROTCH, S. L. N84-15831
GROVER, R. F. N84-15766
N84-15768
GROVES, N. C. N84-15506
GRUN, J. N84-15991
GSCHNEIDNER, K. A. N84-16007
GUILLERMET, J. N84-15239
GUITON, J. N84-15238
GUN, G. S. N84-15564
GUPTA, I. J. N84-15373
GUPTA, S. S. N84-15869
GURTIN, M. N84-15287
GUSTAFSON, E. K. N84-15216
GUSTAFSON, R. N84-15917
GUTMANN, J. C. N84-15817
GUY, A. W. N84-15756

H

HACKMAN, S. T. N84-16065
HACKWELL, J. A. N84-16098
HAERTER, E. C. N84-15126
HAESSLER, H. N84-15236
HALE, G. N84-15928
N84-15930
HALE, I. D. N84-15699
HALE, J. K. N84-15846
HALFORD, G. R. N84-15249
HALL, W. B. N84-16037
HALL, W. H. N84-15050
HALLE, H. N84-15614
HALLQUIST, J. O. N84-15818
HAMANA, S. N84-16094
HAMEETMAN, G. J. N84-15819
HAMEL, W. R. N84-15799
HAMILTON, M. L. N84-15255
HAMILTON, W. P., III N84-16077
HAN, D. N84-16071
N84-16072
N84-16073
N84-16074
HANAMOTO, B. N84-15272
HANEY, J. F. N84-15045
HANKE, D. N84-15163
HANNA, S. L. N84-15576
HANOLD, R. J. N84-15511
HANSEN, R. G. N84-15347
N84-15355
HANSON, A. J. N84-15642
HANSON, J. D. N84-15985
HARALICK, R. M. N84-15632
HARDEE, P. E. N84-16038
HARDLE, W. N84-15847
N84-15867
HARDY, G. H. N84-15067
HARIHARAN, S. I. N84-15897
HARMANNY, A. N84-15447
HARRIS, D. D. N84-15832
HARRIS, J. H. N84-15979
HARRIS, J. M. N84-15267
N84-15765
HARRIS, M. E. N84-15053
HARRIS, P. J. N84-15323
HARRISON, C. G. A. N84-15630
HART, J. E. N84-15706
HARTILL, D. N84-15916
HARTMAN, M. F. N84-15526
HARTT, R. W. N84-16077
HASEGAWA, H. N84-15549
HAVEN, T. N84-15038
HAVERKAMP, H. N84-15317
HAYES, K. N84-15922
HEATH, B. N84-15247
HEATH, J. B. R. N84-15136
HEATH, M. T. N84-15830
HEAVEY., K. R. N84-15127
HEDMAN, S. G. N84-15132
HEGEMIER, G. A. N84-15823
HEIMERL, J. M. N84-15221
HEISIG, R. N84-15346
HEJAZI, M. N84-15198
HELBIG, R. N84-15517
HELLER, H. H. N84-15026
HELLER, K. N84-16015
HELZER, S. G. N84-15141
HEMPHILL, R. R. N84-15905
HENNEKE, E. G. N84-15206
HERBST, M. J. N84-15991
HERCHER, M. N84-15759
HERMANN, A. N84-15691
HERRMANN, R. B. N84-15712
HERRUP, D. N84-15916
HETSCH, J. N84-15519
HEWITT, C. N84-15878
HICKEY, J. S. N84-15732
HICKMAN, R. B. N84-15509
HICKS, H. R. N84-15979
HIEFTJE, G. M. N84-15982

HIERSAKI, Y. N84-15338
HIGUCHI, N. N84-16011
HIKAMI, F. N84-15195
HILBRANDT, E. N84-15182
HILLGER, W. N84-15143
HINZE, W. J. N84-15708
HIRAYAMA, T. N84-16094
HIRSCH, C. N84-15437
HIRSH, R. S. N84-15466
HIRTH, J. P. N84-15222
HITT, E. F. N84-15150
HO, T. N84-15205
HOEGY, W. R. N84-15941
HOFFMAN, M. D. N84-15771
HOGARTH, R. M. N84-15872
HOLDEN, W. L. N84-15780
HOLDER, M. N84-15919
N84-15937
HOLIAN, B. L. N84-15290
HOLKO, M. L. N84-15637
HOLLAND, T. C. N84-15357
HOLLOWAY, P. H. N84-15223
HOLLOWAY, R. W. N84-15968
HOLM, R. G. N84-15633
HOLMES-SIEDLE, A. N84-15971
HOLMES, J. K. N84-15174
N84-15175
N84-15176
N84-15177
HOLST, T. L. N84-15469
HONEY, R. C. N84-15675
HOOGLAND, W. N84-15918
N84-15920
HOOK, W. R. N84-15172
HOOVER, S. A. N84-15297
HORNING, R. R. N84-16081
HORTON, W. N84-15988
HOSSEINI, S. M. N84-15317
HOUCK, J. R. N84-15520
HOUDEVILLE, R. N84-15457
HOUSTON, P. L. N84-15950
HOVER, G. L. N84-15138
HOWELL, K. A. C. N84-15167
HOWELL, L. W. N84-15880
HUANG, C. Y. N84-16007
N84-16012
HUANG, F. H. N84-15255
HUANG, S. Y. N84-15766
N84-15768
HUANG, T. T. N84-15506
HUBER, F. N84-15495
HUBEY, H. M. N84-15624
HUFFERED, W. L. N84-15287
HUFFMAN, P. R. N84-15551
HUGHES, P. S. N84-15404
HUGHES, T. P. N84-15946
HUMPHRIES, R. N84-15269
HUNT, L. R. N84-15877
HURWITZ, M. M. N84-15594
N84-15596
HUSH, D. N84-15406
HUSK, G. R. N84-15225
HUTH, G. K. N84-15174
N84-15175
N84-15176
N84-15177
HWANG, C. M. N84-15578
HYDE, R. W. N84-15785
HYMAN, J. M. N84-15854

I

IDZOREK, G. C. N84-15402
IM, K. E. N84-15535
INOUE, O. N84-15424
IOANNOU, P. J. N84-15704
IRWIN, J. F. N84-15037
ISHIZAKI, Y. N84-15330
ISHMAEL, S. D. N84-15159
ITON, L. E. N84-16013
IWAMOTO, H. N84-15789
IWASAKI, R. S. N84-15174
N84-15175
N84-15176
N84-15177

J

JACKSON, P. J. N84-15300
JACKSON, R. D. N84-15633
JACOBS, E. W. N84-15680
JACOMIN, D. A. N84-15705
JALALI, F. N84-16039
JAMES, L. A. N84-15615
JAQUA, V. N84-15284
JAQUA, V. W. N84-15428
JARAMILLO, S. A. N84-15405
JAROSZ, C. J. N84-15643
JENNINGS, L. D. N84-15524
JENSEN, K. A. N84-16084
JEPPSON, M. R. N84-15359
JESSL, P. N84-15715
JEWITT, D. C. N84-16091
JEYARATNAM, S. N84-15870
JOENSSON, U. N84-15408
JOHNS, W. L. N84-15297
JOHNSON, A. L. N84-15331
JOHNSON, B. M. N84-15907
N84-15908
JOHNSON, C. A. N84-15796
JOHNSON, D. W. N84-15128
JOHNSON, H. W. N84-15829
JOHNSON, J. B. N84-15609
JOHNSON, J. D. N84-15290
JOHNSON, M. C. N84-15809
JOHNSON, N. L. N84-15568
JOHNSON, R. N84-15918
N84-15920
N84-15932
JOHNSON, R. B. N84-15756
JOHNSON, W. L. N84-15278
N84-15813
N84-15825
JOHNSON, W. R. N84-15066
JOISEL, A. N84-15652
N84-15653
JONES, B. H. N84-15765
JONES, C. L. N84-15629
JONES, C. R. N84-15966
JONES, J. A. N84-15350
JONES, K. W. N84-15907
N84-15908
JONES, L. W. N84-15927
JONES, T. D. N84-15698
JONES, W. F. N84-15196
JORDAN, G. W. N84-15279
JORTNER, J. N. N84-15828
JOST, G. S. N84-15147
JSEGER, D. N84-15041
JUBELIN, B. N84-15028
JUDGE, R. N84-15528
JUNG, K. Y. N84-15392

K

KADABA, P. K. N84-16040
KAESTNER, F. N84-15070
KAILASANATH, K. N84-15505
KALINOWSKI, A. J. N84-15601
N84-15602
KALKER, J. J. N84-15833
KANADE, T. N84-15806
KANAMORI, H. N84-15712
KANAZAWA, Y. N84-15339
KANE, V. E. N84-15865
KANEKO, M. N84-15338
KAPETANAKOS, C. A. N84-15945
KAPLAN, F. B. N84-15735
KAPLAN, S. N. N84-15925
KARAGUELLE, H. N84-15565
KARR, G. R. N84-16022
KARRAS, T. W. N84-15543
KASS, R. N84-15918
KASSNER, M. E. N84-15259
KASTNER, C. J. N84-15633
KATO, T. N84-15976
KAUFMAN, L. N84-15773
KAUFMAN, L. G., II N84-15121
KAWAGUCHI, J. N84-15841
KAWASHIMA, I. N84-15244
KAY, P. N84-15820
KEEL, W. C. N84-16100
KELLER, G. R. N84-15708
KELLEY, G. G. N84-15984
KELLEY, N. D. N84-15905
KELLNER, T. P. N84-15758
KENNEL, C. F. N84-15909
KENWORTHY, M. J. N84-15155
N84-15156
KENWORTHY, M. K. N84-15152
KENYON, S. N84-16114
KEPHART, B. N84-15916
KERLING, J. L. N84-15746
KERR, S. N84-16066
KETCHEN, H. G. N84-15138
KEUNG, C. S. N84-15336
KEYSER, D. R. N84-15137
KIKUCHI, R. N84-16000
KILE, J. N. N84-15162
KIM, B. S. N84-15108
KIM, J. G. N84-15365
KIM, K. O. N84-15107
KIM, Y. H. N84-15252
KINDER, T. H. N84-15748
KING, J. W. N84-15656
KING, N. S. P. N84-15405
KIRSCHNER, J. N84-15314
KITTEL, P. N84-15353
KIUTTU, G. F. N84-15946
KLAMUT, C. J. N84-16011
KLEIN, F. F. N84-15404
KLEIN, H. H. N84-15346
KLEINOSKY, P. N84-15814
KLEINROCK, L. N84-15375
N84-15377
N84-15378
KLETTE, R. N84-15812
KNEELAND, B. T. N84-15091
KNIGHT, D. R. N84-15777
KO, W. L. N84-15588
KOBER, E. C. N84-15951
KOCH, W. F. N84-15742
KOEPPEL, W. N84-15715
KOFLER, R. N84-15919
KOH, P. H. N84-15516
KOHLER, W. E. N84-15873
KOIZUMI, T. N84-15339
KOLKA, M. A. N84-15780
KOOPMANN, G. H. N84-15409
KOSTYGOVA, O. V. N84-15232
KOTTOWSKI, H. M. N84-15491
N84-15492
KOTZ, S. N84-15568
KOZAR, V. I. N84-15232
KOZEL, P. N84-15148
KOZLOV, L. Y. N84-15232
KRAJEWSKI, W. N84-15237
KRASSNER, J. N84-16089
KRAUSE, E. N84-15434
KRECHKOVSKAYA, V. I. N84-15584
KRISTOFFERSEN, Y. N84-15640
KROEGER, G. A. N84-15525
KROO, I. M. N84-15134
KUBINA, S. J. N84-15055
KUEBLER-TESCH, G. N84-15293
KUHLMAN, B. P. N84-15733
KULCHAR, A. G. N84-15984
KUMAR, A. N84-15273
KUMAR, R. N84-15422
KUNSCH, P. N84-15489
KUNZ, L. L. N84-15756
KUO, Y. H. N84-15695
KURODA, I. N84-15789
KURTZ, S. E. N84-15693
KWASNIEWSKA-JANKOWICZ, L. N84-15399
KWOH, S. W. N84-15665

L

LA VIOLETTE, P. E. N84-15746
LACOE, R. C. N84-16007
N84-16012
LACOSS, R. T. N84-15903
LADEL, J. N84-15093
LAGALLY, M. G. N84-15944
LAIRD, C. E. N84-16041
LAKE, B. M. N84-15665
LAKSHMINARAYANA, B. N84-15459
N84-15460
LALLY, J. P. N84-15735
LAMM, D. R. N84-15527
LANDIS, D. N84-15790
LANG, H. V. N84-15486
LANG, K. R. N84-16109
N84-16110
LANGEVIN, R. C. N84-15523
LANYON, L. E. N84-15765
LARSEN, J. W. N84-15527
LASALA, G. J., JR. N84-16088
LATEGAN, A. H. N84-15313
LAU, K. S. Y. N84-15274
LAU, S. F. N84-15263
LAVAL, P. N84-15855
LAVIN, P. M. N84-15631
LAVIOLETTE, P. E. N84-15749
N84-15750
LAWFORD, J. A. N84-15530
LAWLER, E. E., III N84-16059
N84-16067
LAWLESS, E. W. N84-16062
LAWS, N. N84-15198
LAXPATI, S. R. N84-15369
LEADER, J. C. N84-15540
LEBRUN, P. N84-15928
N84-15930

LEE, B. H. K. N84-15503
LEE, C. A. N84-15999
LEE, E. H. N84-15257
LEE, H. N84-15103
LEE, H. W. N84-15942
LEE, J. S. N84-15421
LEE, S. S. N84-15565
LEE, Y. H. N84-15726
LEESE, T. M. N84-15045
LEGENDRE, R. N84-15512
LEHRFELD, D. N84-15341
N84-15342
LEIJNSE, C. N84-15113
LEISER, D. N84-15794
LEITH, D. N84-15919
LEITH, D. W. G. S. N84-15934
LEMASTER, R. A. N84-15603
LEMINI, D. G. N84-15287
LEPAGE, G. P. N84-16018
LESTER, H. C. N84-15897
LETALICK, D. N84-15388
LEU, L. Y. N84-15869
LEVINE, D. M. N84-15958
LEVIS, C. A. N84-15380
LEVY, A. N84-15606
LEWIS, A. N84-15782
N84-15783
LEWIS, E. N84-15502
LEWIS, G. N84-15307
LEWIS, J. W. L. N84-15525
LEWY, S. N84-15027
N84-15028
LI, Y. G. N84-16019
LIAS, N. C. N84-15998
LIEN, D. J. N84-16101
LIGRANI, P., M. N84-15449
LIN, M. C. N84-16010
LIN, P. E. N84-15874
LIND, A. R. N84-15771
LINDALE, E. N84-15341
LINDE, C. N84-15135
LINDSAY, D. D. N84-15961
LINDSEY, G. D. N84-15077
LINEHAN, M. N84-15370
LINNEMAN, J. N84-15918
LINSKENS, M. C. N84-15676
LIU, C. C. N84-15261
LIU, C. H. N84-15664
LIU, H. L. N84-15697
LIU, J. N84-15988
LIU, R. W. N84-15400
LIYEPINYA, V. E. N84-15980
LO, H. N84-16071
N84-16072
N84-16073
N84-16074
LO, K. W. K. N84-15639
LOH, E. N84-15919
N84-15937
LOH, N. K. N84-15826
LOHANICK, A. W. N84-15747
LOKEN, S. N84-15918
LOKEN, S. C. N84-15911
LOMBARDI, P. N84-15386
LOMBARDINI, P. P. N84-15668
LONG, R. N84-16058
LONG, S. A. N84-15376
LONGO, M. N84-15885
LOOPER, J. L. N84-15048
LORD, F. M. N84-15791
LORING, C. M. N84-15984
LOURENCO, L. N84-15470
LOURENS, J. A. J. N84-15319
LOVELADY, R. W. N84-15898
LOWENFELD, S. N84-15814
LUBACH, O. A. N84-15969
LUBARD, S. C. N84-15670
LUCIUS, C. N84-15150
LUCKNER, F. N84-15317
LUCKOW, J. R. N84-15297
LUDLAM, J. R. N84-15638
LUDLAM, T. N84-15921
N84-15939
LUDWICK, L. M. N84-16042
LUMBAN-TOBING, F. E. R. N84-15211
LUND, J. N84-15994
LUO, H. L. N84-16012
LUTOMIRSKI, R. F. N84-15670
LYNCH, V. R. N84-15979
LYNN, K. G. N84-15953
LYON, T. F. N84-15151
LYOTHIER, R. N84-15119

M

MAAS, A. N84-15317
MACANDER, A. B. N84-15204
MACCONOCHIE, I. O. N84-15179
MACINA, R. N84-15294
MACIULAITIS, A. N84-15121
MACK, E. J. N84-15162
MADDOX, W. L. N84-15548
MADRONERODELACAL, A. N84-15209
MAGNUSON, W. G., JR. N84-15821
MAHER, J. T. N84-15766
N84-15768
MAISONNEUVE, J. M. N84-15529
MAJKA, R. N84-15918
MALHERBE, J. B. N84-15315
MALMQVIST, M. N84-15408
MANAFZADEH, S. N84-15515
MANDELL, F. J. N84-15586
MANKA, C. K. N84-15989
MANLEY, T. O. N84-15640
MANSELL, M. N84-15071
MANSON, S. S. N84-15249
MANSUR, L. K. N84-15257
MANUALE, A. N84-15889
MARCHENKO, V. A. N84-15584
MARCIANO, W. N84-16015
MARCUS, M. S. N84-15600
MARETTO, L. N84-15475
MARIANI, G. N84-15572
MARINENKO, G. N84-15742
MARK, J. W. N84-15955
MARKHAM, B. L. N84-15634
MARKHAM, J. W. N84-15595
MARONDE, R. G. N84-15174
N84-15175
N84-15176
N84-15177
MARSAN, M. N84-15904
MARSH, A. H. N84-15157
N84-15158
MARSH, S. J. N84-15945
MARSHALL, H. L. N84-16090
MARSHALL, T. C. NJ4-15694
MARSIGLIA, G. N84-15668
MARTIN, C. R. N84-15224
MARTIN, H. L. N84-15799
MARTIN, J. A. N84-15179
MARTINELLI, G. N84-15857
N84-15858
N84-15859
MARTINEZ, B. S. N84-15694
MASON, D. W. N84-15060
MASON, F. C. N84-16043
MASON, W. H. N84-15115
MATHEWS, R. J. N84-15558
MATIN, L. N84-15784
MATOUSEK, M. N84-15295
MATSUBARA, Y. N84-15337
N84-15338
MAURO, C. A. N84-15848
MAY, E. K. N84-15678
N84-15689
MAY, G. A. N84-15637
MAYBERRY, M. C. N84-16009
MAZUMDAR, S. N84-16014
MAZUR, P. O. N84-15928
N84-15930
MCANINCH, G. L. N84-15893
MCBRATNEY, W. F. N84-15285
MCCABE, G. P. N84-15865
MCCAULEY, M. E. N84-15808
MCCORD, R. L. N84-16044
MCCULLOUGH, R. E. N84-15766
N84-15768
MCDONALD, H. O. N84-15228
MCDONALD, M. W. N84-16045
MCEVILLY, T. V. N84-15712
MCFARLAND, M. J. N84-15629
MCGARRY, F. J. N84-15586
MCGLAMERY, B. L. N84-15673
MCINTOSH, A. C. N84-15218
N84-15219
MCKEE, J. H. N84-15594
MCKENNA, H. E. N84-15905
MCLACHLAN, B. G. N84-15133
MCLEAN, E. A. N84-15989
MCMONAGLE, D. R. N84-15159
MCNAMARA, W. G. N84-15091
MCNEE, R. C. N84-16068
MEAD, K. N84-15759
MECH, S. J. N84-15570
MEDINNIS, M. N84-15922
MEHRING, J. W. N84-15391
MEIER, G. E. A. N84-15899
MEIXNER, R. P. N84-15367
MELKMAN, A. A. N84-15853
MELLO, P. N84-15837
MELNIKOV, V. K. N84-15980
MERON, M. N84-15907
N84-15908
MERRILL, R. P. N84-15950
MERRITT, B. T. N84-15968
MESSINA, R. N84-15276
MEULENBERG, A. N84-15682
MEUSEMANN, H. N84-15317
MICHEL, A. N84-15501
MIESCKE, K. J. N84-15871
MIGLIORINI, P. N84-15386
MILES, W. E. N84-15051
MILETTI, J. N84-15523
MILEWSKI, J. V. N84-15157
MILLER, A. N84-15353
N84-15984
MILLER, C. W. N84-15693
MILLER, P. N84-15735
MILLMAN, G. H. N84-15662
MINNAAR, H. F. B. N84-15309
MINODA, K. N84-15244
MIRSKI, Z. N84-15399
MISENCIK, J. A. N84-15246
MITCHELL, R. N84-15757
MITCHELL, R. L. N84-15880
N84-15691
MITCHELL, W. G., JR. N84-15185
MIWA, S. N84-15270
MIZUMOTO, K. N84-15789
MODELL, H. I. N84-15775
MOHLER, R. R. N84-15362
MOHRMAN, A. M., JR. N84-16059
MOLEN, G. M. N84-15983
MOOK, D. R. N84-15901
MOORE, C. A. N84-15675
MOORE, D. S. N84-15510
MOORE, L. G. N84-15766
N84-15768
MOORE, M. J. N84-15476
MORAVEC, H. P. N84-15803
MOREL, R. N84-15450
N84-15451
MORRIS, C. E. K., JR. N84-15145
MORRIS, J. W., JR. N84-15252
MORROW, P. E. N84-15785
MORTON, K. W. N84-15430
MOSKALEVA, L. N. N84-15895
MOSS, W. F. N84-15896
MOTTE, F. N84-15248
MOUTON, P. L. N84-15325
MUELLER, H. N84-15583
MUKHA, I. M. N84-15241
MUKUNDA, N. N84-15383
MULERA, T. N84-15925
MULLER, K. E. N84-15774
MULLEY, W. G. N84-15042
MUNEKATA, T. N84-15338
MUR, G. N84-15410
MURALIDHARAN, U. N84-15249
MURPHY, L. M. N84-15678
MURPHY, M. M. N84-15523
MURRAY, R. C. N84-15818
MUTONE, G. A. N84-15404
MYERS, S. M. N84-16008
MYRTLE, K. N84-15335

N

NADDEF, D. N84-15852
NAGATA, M. N84-15411
NAKATANI, I. N84-16094
NAKAYAMA, K. N84-15612
NARENDRA, K. S. N84-15834
NASH, L. N84-15138
NAST, T. C. N84-15957
NATALI, A. N84-15837
NEDELL, W. N84-15087
NEDZELNITSKY, O. V., JR. N84-15834
NEE, J. B. N84-15703
NEGRIN, M. N84-15876
NELANDER, C. N84-15161
NEMAT-NASSER, S. N84-15823
NEMATOLLAAHI, K. N84-15575
NEMETHY, P. N84-15911
N84-15919
NEUMAN, C. P. N84-15807
NEWCOME, B. H. N84-15815
NEWMAN, W. N84-15336
NGUYEN, L. T. N84-15102
NICHOLSON, A. N. N84-15788
NICHOLSON, W. N84-16080
NICKLES, R. J. N84-15761

NIEROW, A. N84-15720
NIETUBICZ, C. J. N84-15127
NILSEN, P. W. N84-15174
N84-15175
N84-15176
N84-15177
NILSSON, H. N84-15408
NIPPRESS, K. R. N84-15530
NISENOFF, M. N84-15326
NISHI, K. N84-16094
NITZSCHE, F. N84-15623
NIU, T. M. N84-15210
NIXON, S. R. N84-15165
NODULMAN, L. N84-15938
NOEL, B. W. N84-15405
NOMOTO, T. N84-15549
NOVAK, L. V. N84-15731
NOVIKOV, A. V. N84-15574
NYGREN, D. R. N84-15919

O

OBREZKOV, G. V. N84-15963
OBRIEN, T. K. N84-15199
OCONNOR, D. J. N84-16077
OESTBERG, A. N84-15388
OGILVIE, I. N84-15311
OGILVIE, P. L. N84-15606
OGUCHI, H. N84-15424
OHARA, F. M., JR. N84-15836
OHMAN, L. H. N84-15503
OHTSUKA, T. N84-15330
OKLES, J. A. N84-15968
OKADA, T. N84-15806
OLANDER, N. N84-15644
OLDFIELD, D. N84-15039
OLOFSSON, G. N84-15408
ONG, E. N84-15679
ORAN, E. S. N84-15505
ORATOVSKAYA, I. E. N84-15233
OREF, I. N84-15949
ORHAUG, T. N84-15644
ORLANDI, G. N84-15857
N84-15858
N84-15859
OSATO, S. N84-15790
OSBORN, G. C. N84-16004
OSBORN, L. N84-16022
OSBORNE, R. S. N84-15172
OSBOURN, G. C. N84-16006
OSTERYOUNG, R. A. N84-15220
OSTGAARD, J. C. N84-15052
OTOOLE, T. N84-15735
OTT, H. R. N84-16003
OUTLAW, D. G. N84-15744
OWEN, D. H. N84-15779

P

PACKAN, N. H. N84-15257
PADEN, V. L. N84-16068
PADMANABHAN, V. N84-15604
PAIGE, F. E. N84-15915
N84-15939
PAILHAS, G. N84-15458
PALEOLOGOU, E. N84-16099
PALMADESSO, P. N84-15948
PALMER, J. M. N84-15633
PALMER, R. B. N84-15926
PALMER, R. L. N84-15943
PAMIDI, P. R. N84-15605
PAN, C. H. T. N84-15556
PANAYOTOU, N. F. N84-15254
PANCHAPAKESAN, S. N84-15870
PANDOLF, K. B. N84-15769
PANYAM, R. R. N84-15215
PAPANTONI-KAZAKOS, P. N84-15842
PARFENOV, A. A. N84-15895
PARKER, A. C. N84-15849
PARKER, J. A. N84-15202
PARMEGGIANI, A. N84-15572
PARRUCCI, U. N84-15886
PATRICK, R. L. N84-16064
PATTON, J. F. N84-15036
PATTON, R. L. N84-16013
PAUL, A. K. N84-15658
PAUL, M. P. N84-15364
PAUL, R. L. N84-15322
PAULEY, D. E. N84-15368
PAULSON, D. N. N84-15332
N84-15358
PEARSON, D. W. N84-15761
PECHENICK, K. R. N84-16111
PECHMANN, J. B. N84-15702
PEHAK, P. N84-15939
PENG, T. H. N84-15739
PENG, Y. K. M. N84-15984
PEPPER, W. B., JR. N84-15129
PEPPLER, F. W. N84-15496
PEPPLER, W. N84-15495
PEREZ-MENDEZ, V. N84-15925
PERIAUX, J. N84-15468
PERONE, S. P. N84-15397
PETERSON, C. W. N84-15128
PETRENKO, A. M. N84-15233
PETRI, R. J. N84-15679
PETROV, N. N. N84-15232
PETROVIC, J. J. N84-15197
PHILLIPS, N. E. N84-16009
PICARDI, G. N84-15889
PICKREL, E. W. N84-15781
PICKUP, P. G. N84-15220
PIEKUTOWSKI, A. J. N84-15146
PIFKO, A. B. N84-15606
PIMENTAL, N. A. N84-15769
PINGALI, K. N84-15827
PINKUS, A. N84-15853
PIRUSSKII, M. V. N84-15584
PITZ, W. J. N84-15226
PITZER, K. S. N84-16019
PLASKIN, I. N. N84-15242
PLATEEL, C. N84-15335
PLATNER, E. D. N84-15921
N84-15939
POLIAKOFF, E. D. N84-15956
POLUKHIN, V. P. N84-15574
POLYDOROS, A. N84-15174
N84-15175
N84-15176
N84-15177
POPE, B. N84-15917
POPOVA, E. V. N84-15574
PORCO, C. C. N84-16087
PORTIER, J. J. N84-15471
POTTS, T. N84-15401
POURING, A. A. N84-15559
POWELL, P. N84-15820
PRAH, J. D. N84-15774
PRATT, S. T. N84-15956
PRELLER, R. H. N84-15752
PRIETO, N. E. N84-15224
PRIKHODKO, M. U. N84-15241
PRITCHARD, C. L. N84-15291
PROCHAZKA, T. M. N84-15296
PROGAR, D. J. N84-15271
PRONCHICK, S. W. N84-15415
PRONKO, M. S. N84-15983
PROTOPOPESCU, S. D. N84-15915
N84-15939
PRUETT, E. C. N84-16097
PRZYBYTKOWSKI, S. M. N84-15105
PUCCI, F. N84-15886
PUDOV, E. A. N84-15564
PUIGH, R. J. N84-15254
PUJOL, A., JR. N84-16046
PULLEYBLANK, W. N84-15852

Q

QADRI, S. B. N84-16007
QUERRY, M. R. N84-15965
QUEZON, A. J. N84-15600
QUINN, W. J. N84-15071

R

RABINOVITCH, B. S. N84-15949
RADEBAUGH, R. N84-15334
RADESPIEL, R. N84-15116
RAIS, A. B. N84-15238
RAJ, P. K. N84-15439
RAJU, I. S. N84-15201
RAMEAU, B. N84-15493
RAMINS, P. N84-15394
RAPP, R. A. N84-15222
RAZEVIG, V. D. N84-15963
REAZER, J. N84-15733
REDDOCH, T. W. N84-15677
REED, K. A. N84-15676
REED, W. N84-16097
REEDER, M. J. N84-15077
REEVES, J. T. N84-15766
N84-15768
REHAK, P. N84-15924
REIFSNIDER, K. L. N84-15206
REILLY, M. H. N84-15140
REINISCH, B. W. N84-15659
RESING, H. A. N84-16013
RESNICK, S. M. N84-16059
REUTER, W. G. N84-15240
REY, J. A. N84-15047
REYNARD, W. D. N84-15081
RHEINBOLDT, W. C. N84-15861
RICCIARDELLI, J. N84-15345
RICHARDS, F. A. N84-16079
RICHARDSON, J. J. N84-15839
RICKER, G. R. N84-16095
RICKETSON, D. S., JR. N84-15077
RIDER, G. C. N84-15669
RINO, C. L. N84-15650
RIORDAN, G. A. N84-15297
RIPIN, B. H. N84-15989
RISLEY, M. N84-15733
RITTENBERG, A. N84-15910
RITZWOLLER, M. H. N84-15627
RIZZI, A. N84-15464
N84-15465
ROBERT, G. N84-15085
ROBERTS, D. N84-15174
N84-15175
N84-15176
N84-15177
ROBERTS, D. E. N84-15767
ROBERTS, D. K. N84-15735
ROBERTSON, K. B. N84-16097
ROBERTSON, R. E. N84-15280
ROCHE, C. N84-15657
ROCHEFORT, M. A. N84-15268
RODE, R. L. N84-15064
RODERICK, N. F. N84-15946
RODRIGUEZ, E. M. N84-15130
RODRIGUEZ, J. M. N84-16104
ROE, P. L. N84-15431
ROEDER, A. N84-15473
ROENNBERG, I. N84-15408
ROGERS, S. P. N84-15643
N84-15817
ROLAND, A. N84-16076
ROMANOV, L. M. N84-15232
RONAN, M. N84-15918
RONCONI, R. N84-15889
RONNENBURG, C. H. N84-15371
ROSENFELD, M. S. N84-15148
ROSENTHAL, M. S. N84-15761
ROSENTHAL, W. D. N84-15629
ROTHERAM, S. N84-15649
ROUX, J. P. N84-15316
N84-15319
ROVEDA, R. N84-15886
ROWNTREE, R. A. N84-15562
ROY, G. N84-15962
RUBEN, H. D. N84-15079
RUBIN, C. T. N84-15765
RUBIN, G. S. N84-15564
RUDCHENKO, A. V. N84-15584
RUDIGIER, H. N84-16003
RUDY, T. E. N84-15509
RUEDENAUER, F. N84-15301
RUNYAN, R. B. N84-15603
RUSS, A. N84-15922
RUSSO, S. C. N84-15344
RUSTAN, P. L. N84-15733
RYAN, T. N84-15928
N84-15930

S

SABLA, P. E. N84-15151
SABOL, B. A. N84-15946
SACCO, M. N84-15523
SACCO, V. N84-15668
SACKETT, S. J. N84-15818
SAGER, R. E. N84-15332
N84-15358
SAGGESE, E. N84-15386
SAKAI, J. I. N84-15975
SALEMANN, V. N84-15123
SALERNO, M. N84-15858
SALES, G. S. N84-15654
SALMON, L. T. J. N84-15039
SALUAN, M. N84-15046
SAMPSON, J. B. N84-15766
N84-15768
SANDENBERGH, R. F. N84-15321
SANDERS, D. C. N84-15778
SANDERS, G. A., III N84-15169
SANDERSON, A. C. N84-15804
N84-15807
SANDS, B. N84-16080
SANDSTROM, R. L. N84-15690
SANJAUNBENITO, J. P. N84-15281
SARNAVSKII, N. M. N84-15241
SARRAZIN, P. N84-15248

SARTINI, L. N84-15891
SATO, S. I. N84-15424
SATO, T. N84-16094
SAUERS, L. J. N84-15758
SAVAGE, R. N84-15633
SAVINO, J. M. N84-15714
SAWKA, M. N. N84-15769
SCARF, F. L. N84-15972
SCARICH, G. V. N84-15251
SCHAENZER, G. N84-15088
SCHAPERY, R. A. N84-15205
SCHEMMER, M. N84-15306
SCHIJVE, J. N84-15618
SCHILLING, D. L. N84-15383
SCHKADE, D. N84-15805
SCHLAG, J. F. N84-15804
N84-15807
SCHLEIN, P. E. N84-15922
SCHMELLER, M. D. N84-15569
SCHMIDT, G. L. N84-15973
SCHMIDT, R. J. N84-15589
SCHMIDT, S. C. N84-15510
SCHMIDT, W. N84-15094
SCHNEEWEISS, H. N84-15065
SCHNELL, W. D. N84-15243
SCHRECK, R. M. N84-15785
SCHREINER, H. N84-15236
SCHROEDER, D. J. N84-15793
SCHUETZE, R. N84-15143
SCHULZ, H. N84-15212
SCHUSTER, L. S. N84-15588
SCHWAB, G. M. N84-16083
SECRIST, G. E. N84-16068
SEGALL, S. B. N84-15541
N84-15542
N84-15546
SEGAN, E. G. N84-15273
SEIFERT, R. N84-15097
SEILER, J. M. N84-15493
SELLGREN, K. N84-16086
SELLKE, T. N84-15844
SELLSCHOP, J. P. F. N84-15302
SELOVE, W. N84-15931
SENITZKY, I. R. N84-15545
SERRANO, A. N84-15733
SETO, J. N84-15566
SEVENHUIJSEN, P. J. N84-15616
SHACKELFORD, W. M. N84-15229
SHAFFER, L. E. N84-16079
SHAFROTH, S. M. N84-15907
SHANER, J. W. N84-15510
SHAPIRO, P. N84-15345
N84-16113
SHAW, J. N84-15072
SHAW, M. S. N84-15290
SHAW, S. W. N84-15577
SHEARMAN, E. D. R. N84-15655
SHELEKHOV, E. V. N84-15234
SHELTON, J. P. N84-15369
SHEPHARD, R. W. N84-16065
SHERMAN, A. N84-15329
SHIMIZU, S. N84-15789
SHINAR, J. N84-15876
SHOCHET, M. N84-15918
SHORE, R. A. N84-15361
SHOSHANI, A. N84-16080
SHROCK, R. N84-16015
SHUGAR, T. A. N84-15843
SHUNLIN, Z. N84-15122
SIAMAK, K. N84-15645
SIAS, F. R., JR. N84-16047
SICARD, A. J. N84-15557
SIDORENKOV, N. S. N84-15709
SIEBERS, D. L. N84-15412
SIEGRIST, K. N84-16048
SIGURDSON, K. B. N84-15349
SIMHA, R. N84-15280
SIMILON, P. L. N84-15987
SIMON, B. N84-15043
SIMON, H. N84-15213
SIMON, R. N84-15383
SINCLAIR, M. J. N84-15527
SINGLER, T. J. N84-15414
SINGPURWALLA, N. D. N84-15567
SIDSMITH, H. N84-15340
SKAKOV, Y. A. N84-15234
SKALSKI, S. C. N84-15153
N84-15154
SKELTON, E. F. N84-16007
SLATER, P. N. N84-15633
SLOOFF, J. W. N84-15131
N84-15860
SMITH, A. M. N84-15922
SMITH, B. R. N84-15126
SMITH, C. J. N84-15071
SMITH, C. V. N84-15595
SMITH, D. M. N84-16062
SMITH, D. R. N84-16049
SMITH, G. C. C. N84-15597
N84-15598
SMITH, J. E., JR. N84-16050
SMITH, J. L. N84-16003
SMITH, K. F. N84-15090
SMITH, M. G. N84-16082
N84-16083
SMITH, M. S. N84-15525
SMITH, O. E. N84-15866
SMITH, P. H. N84-15731
SMITH, R. A. C. N84-15075
SMITH, S. F. N84-15838
N84-16063
SNELL, C. N84-15978
SNELLING, K. S. N84-15095
SNIPES, M. B. N84-15694
SNKOLLER, B. N84-15714
SNOECK, J. N84-15484
SNOVER, K. A. N84-15954
SNOWDON, S. C. N84-15892
SOLOWAY, E. N84-15813
N84-15825
SONOYA, K. N84-15244
SPALART, P. R. N84-15413
SPARKS, W. N84-16114
SPENCER, D. W. N84-15701
SPEYER, J. J. N84-15101
SPIESS, F. N. N84-15753
SPINDLER, W. C. N84-15397
SPINK, T. E. N84-15036
SPIVAK, A. L. N84-15353
SPONG, D. A. N84-15986
SPRANGLE, P. N84-15945
N84-15947
SQUILLANTE, M. N84-15994
STACY, A. B., JR. N84-15180
STAMPER, J. A. N84-15989
N84-15991
STANDER, C. M. N84-15318
STARKEN, H. N84-15552
STARRETT, R. E. N84-15993
STARRFIELD, S. N84-16114
STENSBY, J. N84-16051
STEPHENSON, J. B. N84-15228
STEVENS, J. L. N84-15714
STEVENSON, D. A. N84-15996
STEWART, D. N84-15186
STEYERT, W. A. N84-15354
STEYSKAL, H. N84-15407
STILLWELL, R. P. N84-15970
STINCHCOMB, W. W. N84-15206
STOCK, M. N84-15440
N84-15441
STOCKER, J. N84-15073
STOLFI, F. N84-15345
STOLZ, J. W. N84-15742
STONE, B. M. N84-15788
STRANGMAN, T. E. N84-15247
STROHM, G. A. N84-16063
STRUWE, D. N84-15497
N84-15498
STUCKEY, J. M. N84-15269
STUDER, F. A. N84-15890
STUDER, P. A. N84-15555
STUMPF, H. N84-15582
STUREK, W. B. N84-15127
STURLESE, S. N84-15320
SU, R. N84-15877
SUDARSHAN, E. C. G. N84-15383
SUENAGA, M. N84-16011
SUGIHARA, R. N84-15975
SULIT, R. A. N84-15569
SULLIVAN, D. B. N84-15333
N84-15334
SULLIVAN, D. J. N84-15946
SUN, M. N84-15106
SUSSMAN, M. B. N84-15123
SUYDAM, B. R. N84-15967
SUZUKI, M. N84-15339
SVENSSON, L. N84-15786
SWAFFORD, T. W. N84-15504
SWIFT, H. F. N84-15146
SWIFT, W. L. N84-15340
SWORTZEL, F. R. N84-15063
SYDNOR, R. L. N84-15536

T

TAGG, M. N84-15592
TAILLET, J. N84-15086
TAKAHASHI, K. N84-16106
TAKAHASHI, M. N84-15339
TAKEDA, H. N84-15542
N84-15546
TALUKDAR, S. N. N84-15802
TANAKA, M. N84-15612
TANG, J. S. N84-15659
TANG, P. K. N84-15977
TANGE, T. N84-16094
TANIMOTO, T. N84-15710
TANIS, J. A. N84-15907
TANNENBAUM, M. N84-15918
TANNENBAUM, M. J. N84-15933
TAYLOR, R. N84-15370
TENHAVE, A. A. N84-15149
TEOH, W. N84-16052
TESTER, B. J. N84-15029
THACKRAY, R. I. N84-15795
THARALDSON, R. A. N84-15992
THEBAUD, L. R. N84-15670
THEIS, S. W. N84-15629
THEODOSIOU, G. N84-15931
THEODOSIOU, G. E. N84-15929
THIBADEAU, R. N84-15566
THIEBERGER, P. N84-15908
THOMPKINS, W. T., JR. N84-15360
THOMPSON, D. S. N84-15114
THOMPSON, J. M. N84-16053
THOMPSON, L. M. N84-15269
THORNTON, B. N84-15592
TIEMANN, W. N84-15640
TILLER, W. A. N84-15997
TILTON, B. M. N84-15760
TIMM, R. N84-15899
TODD, M. J. N84-15562
TOLBERT, R. N. N84-16054
TOMEI, F. N84-15757
TOMISAWA, Y. N84-15244
TONOLINI, F. N84-15571
TOUCHSTONE, R. M. N84-15795
TOWNE, D. M. N84-15809
TOWNLEY, C. T. N84-16070
TRAPP, R. L. N84-15371
TRASK, R. P. N84-15745
TREBINO, F. P. N84-15531
TREINISH, L. A. N84-15731
TROILO, M. N84-15474
TRONRUD, L. B. N84-15713
TRURAN, J. N84-16114
TRUSOV, V. A. N84-15233
TSAI, B. M. N84-15535
N84-15674
TSENG, K. N84-15104
TSUCHIYA, K. N84-16011
TUBBS, J. D. N84-15178
N84-15866
TUMANOVA, N. K. N84-15241
TUNG, F. C. N84-15181
TURCOTTE, M. D. S. N84-15245
TURLAND, B. D. N84-15500
TURNER, C. M. N84-15548
TWARD, E. N84-15354

U

UCHIDA, T. N84-15339
UDALOV, S. N84-15174
N84-15175
N84-15176
N84-15177
UFFELMAN, D. R. N84-15660
N84-15661
ULLMAN, S. N84-15792
URAMOTO, J. N84-15974
URBAHN, H. N84-15317
URRY, V. W. N84-15824
UTELL, M. J. N84-15785
UTT, E. L. N84-15380

V

VALLEGRA, J. V. N84-16095
VALLERGA, J. B. N84-16096
VALLOR, R. N84-15276
VANDAM, C. P. G. D. N84-15142
VANDAM, J. W. N84-15986
VANDEGRAAFF, R. C. N84-15798
VANDENBERG, B. N84-15513
VANDENBERG, P. M. N84-15389
N84-15864
VANDERLEEDEN, G. A. N84-15690
VANDERMERWE, J. H. N84-15326
VANDERSPEK, R. K. N84-16095
VANKA, S. P. N84-15508
VANLEER, B. N84-15462
VANVALKENBURG, C. N. N84-16097
VANWYK, G. N. N84-15313
VARADAN, V. K. N84-15381

VARADAN, V. V. N84-15381
VARMA, I. K. N84-15202
VEERS, P. S. N84-15613
VELAZQUEZ-SAAVEDRA, J. J. N84-15419
VELDMANN, A. E. P. N84-15862
VELLI, Y. Y. N84-15707
VERHEIJ, T. N84-15787
VEST, G. W. N84-15256
VIDALI, P. N84-15572
VIEHBOECK, F. N84-15301
VILASAGAR, S. N84-15262
VILJOEN, P. E. N84-15319
VON LAVEN, S. N84-15541
N84-15546
VONERICHSEN, L. C. N84-15317
VONFRESE, R. R. B. N84-15708
VONGLINOW, M. A. N84-16061
N84-16066
VORONOV, A. N. N84-15233

W

WACKERLE, J. N84-15292
WAGGENSPACK, W. N., JR. N84-15828
WAGNER, C. A. N84-15601
N84-15602
WAGNER, R. L. N84-15928
N84-15930
WAGONER, D. E. N84-15928
N84-15930
WALCH, M. N84-15757
WALKO, R. L. N84-15725
WALLACE, D. R. N84-15594
WALLCRAFT, A. J. N84-15751
WALTON, A. J. N84-15563
WALUK, M. N84-15550
WAMBSGANSS, M. W. N84-15614
WANDLING, C. R. N84-15569
WANG, C. M. B. N84-15418
WANG, J. C. N84-16055
WANG, S. N84-15632
WANHILL, R. J. H. N84-15617
WARD, A. O. N84-15057
WARD, J. F. N84-15541
WARD, R. N84-15084
WARE, W. H. N84-16064
WARNER, T. T. N84-15730
WATSON, K. M. N84-15902
WEATHERALL, J. N84-16108
WEBB, A. W. N84-16007
WEBB, J. N84-15150
WEBSTER, C. R. N84-15537
WEEKS, G. E. N84-16056
WEGNER, H. E. N84-15908
WEHNER, G. K. N84-15312
WEIKLE, D. C. N84-15366
WEIL, J. V. N84-15766
N84-15768
WELLS, W. H. N84-15672
WENDLING, P. N84-15740
WEST, C. D. N84-15560
WESTBROOK, C. K. N84-15226
WESTBROOK, R. D. N84-15690
WESTFALL, L. J. N84-15203
WEWERINKE, P. H. N84-15798
WEYGAND, D. P. N84-15915
WHEELER, T. G. N84-15760
WHITCOMB, J. D. N84-15200
N84-15201
WHITE, C. L. N84-15091
WHITE, C. W. N84-15758
WHITE, R. G. N84-15100
WHITHAM, K. N84-15968
WHITWORTH, H. A. N84-15194
WIEDENBECK, P. N84-15925
WIEHL, H. J. N84-16107
WILCOX, R. B. N84-15968
WILDMAN, W. J. N84-15061
WILGEN, J. B. N84-15984
WILKES, D. N84-15269
WILLIAMS, A. N84-15278
WILLIAMS, C. A. N84-15771
WILLIAMS, G., JR. N84-16057
WILLIAMS, J., JR. N84-15565
WILLIAMS, P. D. L. N84-15667
WILLIAMSON, S. J. N84-15773
WILLIS, W. J. N84-15912
WILLSON, R. F. N84-16109
N84-16110
WILSON, J. D. N84-15724
WILSON, P. D. N84-15186
WIMBERLY, F. C. N84-15807
WINACOTT, E. L. N84-15657
WINGERSKY, M. S. N84-15791
WINTER, C. N84-15335
WINTERHAGER, H. N84-15237
WIRSEN, A. N84-15208
WOHLRAB, R. N84-15553
WOLF, D. E. N84-15425
WOLF, S. A. N84-16007
N84-16012
WONG, N. C. N84-15533
WOOD, E. C. N84-15080
WOOD, R. F. N84-15690
WOODFIELD, A. A. N84-15087
WOODS, J. F. N84-15087
WOODY, C. D. N84-15776
WRIGHT, J. D. N84-15423
WRIGHT, L. A. N84-15946
WU, C. D. N84-15681
WU, C. F. J. N84-15851
WU, S. T. N84-15636
WUDL, F. N84-16012
WYBENGA, F. T. N84-15306

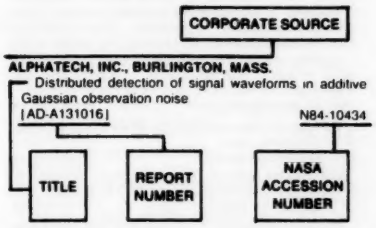
Y

YAJUN, L. N84-15122
YAMAZAKI, K. N84-15973
YANG, C. T. N84-15420
YASUKOCHI, K. N84-15337
N84-15338
YATES, G. J. N84-15405
YATTEAU, J. H. N84-16103
YEAGER, E. N84-15681
YEH, K. C. N84-15664
YERMAS, J. P. N84-15372
YETTER, J. A. N84-15123
YOLTON, R. L. N84-15772
YOON, S. C. N84-15416
YOUNG, D. T. N84-16105
YOUNG, F. C. N84-15991
YOUNG, J. B. N84-15483
YOUNG, N. J. B. N84-15074
YOUNG, R. T. N84-15690
YU, L. T. N84-15276
YUDOW, B. D. N84-15684
N84-15685
N84-15686
YURCHENKO, Z. I. N84-15981

Z

ZAKE, M. V. N84-15980
ZANN, D. A. N84-15052
ZARDECKI, A. N84-15539
ZEEUWEN, J. P. N84-15443
N84-15444
ZHADAN, V. T. N84-15233
ZIAGOS, J. P. N84-15696
ZILLIAC, G. N84-15125
ZIMMERMAN, J. E. N84-15333
N84-15334
ZIPPERIAN, T. E. N84-16006
ZONDERVAN, K. P. N84-15166
ZUYEVA, N. M. N84-15981
ZWEIBEL, K. N84-15691

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, NEUILLY-SUR-SEINE (FRANCE).
Advanced Concepts for Avionics/Weapon System Design, Development and Integration
[AGARD-CP-343] N84-15034
Flight Mechanics and System Design Lessons From Operational Experience
[AGARD-CP-347] N84-15076
Calibration of air-data systems and flow direction sensors. AGARD Flight Test Techniques Series, volume 1
[AGARD-AG-300-VOL-1] N84-15530
Propagation Factors Affecting Remote Sensing by Radio Waves
[AGARD-CP-345] N84-15646
Medical aspects of survival: Training for aircrew
[AGARD-AG-283(FR)] N84-15787
Sleep and wakefulness handbook for flight medical officers
[AGARD-AG-270(FR)] N84-15788

AERITALIA S.P.A., CASELLE TORINESE (ITALY).
Critical factors and operational research in tactical fighter avionic system development N84-15062

AERITALIA S.P.A., TORINO (ITALY).
Flight parameters recording for safety monitoring and investigations N84-15083

AERONAUTICAL RESEARCH INST. OF SWEDEN, BROMMA.
Practical three-dimensional mesh generation using transfinite interpolation N84-15463
Explicit multistage finite volume procedure to solve the Euler equations for transonic flow N84-15464
Vector coding the finite volume procedure for the CYBER 205 N84-15465

AERONAUTICAL RESEARCH INST. OF SWEDEN, STOCKHOLM.
Calculation of transonic flow around two wing-fuselage combinations using a full potential equation method
[FFA-137] N84-15132

AERONAUTICAL RESEARCH LABS., MELBOURNE (AUSTRALIA).
Report on visit to the US and Europe in May 1983, covering the 1983 ICAF (International Committee on Aeronautical Fatigue) Meetings and related visits
[AD-A133415] N84-15147

AEROSPACE CORP., EL SEGUNDO, CALIF.
Spacecraft-borne long life cryogenic refrigeration: Status and trends N84-15331

AIR FORCE ACADEMY, COLO.
Wake characteristics and interactions of the Canard/wing lifting surface configuration of the X-29 forward-swept wing flight demonstrator
[AD-A133188] N84-15126

AIR FORCE AVIONICS LAB., WRIGHT-PATTERSON AFB, OHIO.
Network communications for a distributed avionics system N84-15052

AIR FORCE PACKAGING EVALUATION AGENCY, WRIGHT-PATTERSON AFB, OHIO.
Evaluation of type 2 fast packs for electrostatic discharge properties
[AD-A133158] N84-15557

AIR FORCE SYSTEMS COMMAND, WRIGHT-PATTERSON AFB, OHIO.
Journal of Engineering Thermophysics (selected articles)
[AD-A133167] N84-15184
Utilization of low temperatures in electrical machines
[AD-A133325] N84-15399
Methods of the analysis of the disruption of tracking
[AD-A133335] N84-15963
First UFO incident for our country
[AD-A133326] N84-16058

AIR FORCE WRIGHT AERONAUTICAL LABS., WRIGHT-PATTERSON AFB, OHIO.
AFTI/F-16: An integrated system approach to combat automation N84-15063
Composite laminate weight optimization on the HX-20
[AD-A133490] N84-15207
Airborne lightning characterization
[AD-A130627] N84-15733

AIR FRANCE, PARIS.
The analysis of records of parameters: An indispensable tool in oversight and in operations control N84-15082

AIRBUS INDUSTRIE, BLAGNAC (FRANCE).
Certification experience with methods for minimum crew demonstration N84-15101

AIRESEARCH MFG. CO., TORRANCE, CALIF.
Advanced high-power generator for airborne applications
[AD-A133290] N84-15398

AKTIEBOLAGET ROLLAB, STOCKHOLM (SWEDEN).
A quasi-continuous transonic wind tunnel for cryogenic operation
[ROLLAB-MEMO-RM-096] N84-15161

ALABAMA A & M UNIV., HUNTSVILLE.
Logic simulator program N84-16023
Partial analysis of Insta-Foam N84-16030
Compositional segregation in unidirectionally solidified solid solution crystals N84-16055

ALABAMA A & M UNIV., NORMAL.
Laboratory automation of a quadrupole mass spectrometer N84-16053

ALABAMA UNIV., HUNTSVILLE.
New polymers for low-gravity purification of cells by phase partitioning
[NASA-CR-170957] N84-15267
Research reports: 1983 NASA/ASEE Summer Faculty Fellowship Program
[NASA-CR-170942] N84-16022
The generalized Euler-Mascheroni constants N84-16024
Reflectance measurements, part 2 N84-16026
A study of accretion in compact sources: Disk precession and jet helicity N84-16038
Characteristics of RF lightning emission at 2 GHz and 250 MHz N84-16039
Statistical analysis of a debugging model N84-16048
Determination of systems suitable for study as monotectic binary metallic alloy solidification models N84-16050
Orbital maneuvering vehicle simulation system on-board processing logic N84-16052
Finite element analysis of a deployable space structure N84-16056

AMES LAB., IOWA.
Electrical conductivities of polycrystalline and single-crystal Er2O3-stabilized hafnia
[DE83-017681] N84-15279
Moessbauer spectroscopy study of amorphous Fe87B11Au2 ribbon and its crystallization products
[DE83-018091] N84-16010

ANACAPA SCIENCES, INC., SANTA BARBARA, CALIF.
Evaluation of map symbols for a computer generated topographic display: Transfer of training, symbol confusion, and association value studies
[AD-A133590] N84-15643
Displaying colors of specified chrominance on a color graphics display
[AD-A133591] N84-15817

ANSALDO S.P.A. GENOA (ITALY).
Aerodynamics and steam wetness fraction of a multistage turbine. Comparison of prediction with experimental data N84-15475

APPLIED PHYSICS LAB., JOHNS HOPKINS UNIV., LAUREL, MD.
Issues critical to the application of adaptive array antennas to missile seekers
[AD-A133401] N84-15371
Higher order approximations in fluid mechaniams: Compact to spectral N84-15468

ARETE ASSOCIATES, INC., ENCINO, CALIF.
Lidar remote sensing of internal waves and optical properties N84-15670

ARGONNE NATIONAL LAB., ILL.
Fully coupled calculation of fluid flows with limited use of computer storage
[DE84-002218] N84-15508
Tube vibration in industrial-size test heat exchanger (90 deg square layout)
[DE83-011931] N84-15614
Muons and electrons in general N84-15936
Angular coverage of detectors N84-15940
Photoelectron studies of resonant multiphoton ionization of CO via the A-1 Pi state
[DE83-008535] N84-15956
High-resolution solid-state (13)C NMR study of the templating cations in tetrapropylammonium fluoride silicalite: The effect of steric interactions
[DE83-011706] N84-16013
Future search for grand unified theory magnetic monopoles
[DE83-009451] N84-16015

ARIZONA STATE UNIV., TEMPE.
Theoretical calculation of rapid X-ray transients and radius expansion
[DE84-001312] N84-16114

ARIZONA UNIV., TUCSON.
Effects of wall interference on unsteady transonic flows N84-15105
In-flight absolute radiometric calibration of the thematic mapper
[E84-10064] N84-15833
A numerical investigation of the formation of secondary vortices in laboratory-simulated tornadoes N84-15725

ARKANSAS UNIV., FAYETTEVILLE.
Statistical modeling of Space Shuttle environmental data
[NASA-CR-170940] N84-15178

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, WATERVLIET, N. Y.
Elastic-plastic analysis of annular plate problems using NASTRAN N84-15607

ARMY AVIATION ENGINEERING FLIGHT ACTIVITY, EDWARDS AFB, CALIF.
Rotorcraft icing technology: An update N84-15084

ARMY COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.
Aerostat icing problems
[AD-A133403] N84-15272
Stress measurements in ice
[AD-A133906] N84-15609

ARMY CONSTRUCTION ENGINEERING RESEARCH LAB., CHAMPAIGN, ILL.
Preliminary investigation of ceramic-coated anodes for cathodic protection
[AD-A133440] N84-15273
An interactive soils information system. Users manual
[AD-A133480] N84-16078

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
Abrasion-erosion resistance of concrete made with two aggregates, Stonewall Jackson Dam, West Virginia
[AD-A133432] N84-15357

Computer-Aided Structural Engineering (CASE) project. User's guide: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133600] N84-15611

ARMY MATERIALS AND MECHANICS RESEARCH CENTER, WATERTOWN, MASS.
The polarization ratio of crystal monochromators
[AD-A133181] N84-15524

ARMY MEDICAL BIOENGINEERING RESEARCH AND DEVELOPMENT LAB., FORT DETRICK, MD.
Neurobehavioral effects of carbon monoxide (CO) exposure in humans protocol 1
[AD-A133891] N84-15774

ARMY MISSILE COMMAND, REDSTONE ARSENAL, ALA.
A study to determine the accuracy of 2 computer programs in predicting hinge moments for all movable tail fins on missile bodies
[AD-A133399] N84-15169

ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER, FORT BELVOIR, VA.
Development of quantitative infrared analysis for monitoring water and emulsifying agents in fire-resistant microemulsion diesel fuels
[AD-A133242] N84-15286

ARMY RESEARCH AND TECHNOLOGY LABS., FORT EUSTIS, VA.
Army helicopter crashworthiness N84-15090

ARMY RESEARCH INST. OF ENVIRONMENTAL MEDICINE, NATICK, MASS.
Development and assessment of the Monark cycle ergometer for anaerobic muscular exercise
[AD-A133173] N84-15523
The effects of dehydration on peripheral cooling
[AD-A130836] N84-15767
Differentiated ratings of perceived exertion and selected physiological responses during prolonged upper and lower body exercise
[AD-A134086] N84-15769
Heat exchange following atropine injection before and after heat acclimation
[AD-A132618] N84-15780
Effectiveness of two portable liquid-cooled undergarments in reducing heat stress
[AD-A133174] N84-15801

ARMY SAFETY CENTER, FORT RUCKER, ALA.
Investigation, reporting and analysis of US Army aircraft accident N84-15077

ARMY TRAINING DEVELOPMENT INST., FORT MONROE, VA.
Evaluation results for the interactive video competency recognition system
[AD-A133052] N84-15796

ARO, INC., ARNOLD AIR FORCE STATION, TENN.
Three-dimensional, time-dependent, compressible, turbulent, integral boundary-layer equations in general curvilinear coordinates and their numerical solution
[AD-A133289] N84-15504

ATSUKO COMPUTING INTERNATIONAL, HUNTSVILLE, ALA.
Analysis of severe storm data
[NASA-CR-170947] N84-15732

AUBURN UNIV., ALA.
Hydrogen ignition for laser propulsion N84-16026
Linear and nonlinear aspects of rotordynamics N84-16034
Atomic oxygen effects on materials N84-16036

AURORA ASSOCIATES, INC., WASHINGTON, D.C.
Computer science and technology: Future information processing technology, 1983
[PB83-257618] N84-15820

AVIONS MARCEL DASSAULT-BREGUET AVIATION, SAINT-CLOUD (FRANCE).
Combined visualization N84-15043
Connecting aircraft and external loads N84-15046
First level integrated maintenance in weapons systems N84-15054
Methods for developing the navigation and weapon systems of the Mirage 2000 N84-15068
The MIRAGE 2000: Fly by wire control and safety N84-15093

AXIOMATIX, LOS ANGELES, CALIF.
Engineering evaluations and studies. Volume 1: Exhibit A
[NASA-CR-171724] N84-15174
Engineering evaluations and studies. Volume 2: Exhibit B, part 1
[NASA-CR-171725] N84-15175
Engineering evaluations and studies. Volume 2: Exhibit B, part 2
[NASA-CR-171726] N84-15176
Engineering evaluations and studies. Volume 3: Exhibit C
[NASA-CR-171727] N84-15177

B

BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Computations of projectile magnus effect at transonic velocities
[AD-A133212] N84-15127
Transport algorithms for methane flames
[AD-A133213] N84-15221
Catalysis of nitramine propellants by mmtal borohydrides
[AD-A133215] N84-15285

BATTELLE COLUMBUS LABS., OHIO.
Validation of digital systems in avionics and flight control applications handbook, volume 1
[AD-A133222] N84-15150

BATTELLE INST., FRANKFURT AM MAIN (WEST GERMANY).
Identification of problem areas N84-15440
Practical approaches in accident analysis N84-15441
Flat cloud modeling N84-15442
Development of generic mobility-terrain data bases: Investigation of critical soil parameters
[AD-A133595] N84-15715

BDM CORP., MCLEAN, VA.
Report and recommendations for improving constitutive relations used in computer codes
[AD-A133239] N84-15823

BELL AEROSPACE CO., BUFFALO, N. Y.
Acoustical modes of arbitrary volumes using NASTRAN transient heat transfer RF9 N84-15597
An alternative method of analysis for base accelerated dynamic response in NASTRAN N84-15598

BEN GURION UNIV. OF THE NEGEV, BEERSHEVA (ISRAEL).
A comparison of map learning methods: Map study, simulated travel and mixed
[AD-A133544] N84-15794

BENDIX CORP., KANSAS CITY, MO.
Off-line graphics processing: A case study
[DE84-002420] N84-15832

BENDIX FIELD ENGINEERING CORP., GRAND JUNCTION, COLO.
Uranium anomalies in Wyoming and parts of adjacent states. National Uranium Resource Evaluation
[DE83-005353] N84-15638

BERKELEY SCIENTIFIC TRANSLATION SERVICE, CALIF.
Bending elasticity of circularly notched bars as monolithic flexure hinges in precision mechanisms
[DE84-002199] N84-15612

BERRY COLL., MOUNT BERRY, GA.
A FMCW radar ranging device for the teleoperator maneuvering system N84-16045

BIRMINGHAM UNIV. (ENGLAND).
A review of propagation and scattering factors in remote-sensing and ship-tracking by HF radar N84-15655

BOEING MILITARY AIRPLANE DEVELOPMENT, SEATTLE, WASH.
Inlet flow field investigation. Part 1: Transonic flow field survey
[NASA-CR-172239] N84-15123

BOEING MILITARY AIRPLANE DEVELOPMENT, WICHITA, KANS.
Design and verification of electromagnetic compatibility in airborne weapons systems N84-15066

BONN UNIV. (WEST GERMANY).
Kinematics of the structure and morphology during surface reactions between transition metals and molecular hydrogen N84-15317

BOSTON UNIV., MASS.
Nonlinear Green's function method for transonic potential flow N84-15104

BRANDEIS UNIV., WALTHAM, MASS.
Differences between positrons and electrons in elastic and inelastic processes at surfaces
[DE84-001208] N84-15953

BRITISH AEROSPACE AIRCRAFT GROUP, BROUGH (ENGLAND).
Techniques for interbus communication in a multibus avionic system N84-15050

BRITISH AEROSPACE PUBLIC LTD. CO., GODALMING (ENGLAND).
Modern flight instrument displays as a major military aviation flight safety weakness N84-15098

BRITISH AEROSPACE PUBLIC LTD. CO., PRESTON (ENGLAND).
CASCADE: A design environment for future avionic systems N84-15057
A practical approach to the design of a new avionic system N84-15058
Hardware-in-the-loop simulation techniques used in the development of the Sea Harrier avionic system N84-15071
A dynamic approach to military avionics systems testing N84-15075

BRITISH GAS CORP., LONDON (ENGLAND).
Complete sample analysis by gas chromatography
[BLL-T6213/BG/LRS/LRST671/83] N84-15212

BRITISH LIBRARY LENDING DIV., BOSTON SPA (ENGLAND).
Powder metallurgy
[BLL-M-35271-(5828.4)] N84-15231
Influence of alloying on the properties of nickel in the solid and liquid states
[BLL-M-35284-(5828.4)] N84-15232
Stability of mechanical properties of cold-drawn rolled metal with high-temperature thermomechanical treatment
[BLL-M-35292-(5828.4)] N84-15233
Calculation of structure factor for different cluster models of an amorphous alloy
[BLL-M-35293-(5828.4)] N84-15234
Comparative study of TiN hard coatings produced by reactive sputtering, ion-plating and CVD technique
[BLL-RARDE-TR-1094(7291.7965)] N84-15236
Integrated evaluation of the quality of steel cable wire
[BLL-M-35267-(5828.4)] N84-15564
Theoretical and experimental determination of stress-strain of high-pressure equipment
[BLL-M-35287-(5828.4)] N84-15574
Fracture resistance of hardened and tempered pipes of 16GFR steel
[BLL-M-35268-(5828.4)] N84-15584
Aspects of damping of sonic vibrations due to impact loading in plate steels
[BLL-M-35295-(5828.4)] N84-15895

BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Lattice gauge theories
[DE83-013114] N84-15906
Improved four-stage accel-decel production of low-energy stripped heavy ions
[DE83-005791] N84-15908
Track chambers for high luminosity N84-15921
The design and expected performance of a fast scintillator hadron calorimeter N84-15926
Triggering at high luminosity: Fake triggers from pile-up N84-15932
Fast asynchronous level 1 pre-trigger for electrons at L = 10/sup 33 cm-2 sec-1 N84-15933
Use of synchrotron radiation for electron identification at high luminosity N84-15935
Operation of a high-P/sub T spectrometer arm at 10/sup 33 cm-2 sec-1 with praticle identification N84-15937
Detecting heavy quark jets N84-15939

BROWN, BOVERIE UND CIE, A.G. BADEN (SWITZERLAND).
The design of modern Low Pressure (LP) steam turbines N84-15473
Steam condenser developments N84-15486

BROWN UNIV., PROVIDENCE, R. I.
Introduction to dynamic bifurcation
[AD-A133252] N84-15846

BROWN (W. S.), INC., SALT LAKE CITY, UTAH.
Commercialization of opportunities for materials processing in low gravity
[NASA-CR-170953] N84-15165

BUNDESAMT FUER WEHRTECHNIK UND BESCHAFFUNG, KOBLENZ (WEST GERMANY).
Guidelines and criteria for the functional integration of avionic systems with crew members in command N84-15044

BUREAU OF MINES, ROLLA, MO.
Chemical vapor deposition of group IVB, VB, and VIB elements with nonmetals. A literature review
[PB83-225409] N84-15228

C

CALHOUN COMMUNITY COLL., DECATUR, ALA.
Evaluation of the separability of monodisperse polystyrene latex microspheres in a continuous flow electrophoresis system N84-16057

CALIFORNIA INST. OF TECH., PASADENA.
The effect of flow oscillations on cavity drag, and a technique for their control N84-15109
Optimal low thrust, three burn orbit transfers with large plane changes N84-15166
Nonlinear acoustics instabilities in combustion chambers N84-15230
EXAFS studies of the metallic glass La80Ga20
[DE84-002022] N84-15278
Interpretation of near-source ground motion and implications N84-15697
Constraints on the Earth's anelastic and aspherical structure from antipodal surface waves N84-15700
Thermal tides in the atmosphere of Venus N84-15702

Lateral heterogeneity and azimuthal anistropy of the upper mantle: Love and Rayleigh waves 100-250 sec [NASA-CR-174819] N84-15710
X-ray observations of cataclysmic variables N84-16084
Near infrared studies of reflection nebulae N84-16086
Voyager observations of Saturn's rings. 1: The eccentric rings at 1.29, 1.45, 1.95 and 227 Rs N84-16087
Part 1: Physical studies of distant comets. Part 2: Morphologies of planetary nebulae N84-16091

CALIFORNIA UNIV., BERKELEY.
The nature of quasicleavage fracture in tempered 5.5 ni steel after hydrogen charging [AD-A133460] N84-15252
State-of-the-Art for assessing earthquake hazards in the United States. Report 20: The contribution of directivity focusing to earthquake intensities [AD-A132863] N84-15716
A survey of network reliability [AD-A133545] N84-15835
Production networks: A dynamic model of production [AD-A133571] N84-16085
Studies of highly variable galactic X-ray sources with HEAO-1 [NASA-CR-170941] N84-16112

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Lethal, potentially lethal lesion model [DE84-001325] N84-15762
Major detectors in elementary particle physics [LBL-91] N84-15910
Proceedings of the 1983 DPF Workshop on Collider Detectors: Present Capacities and Future Possibilities [LBL-15973] N84-15911
Experience of the axial field spectrometer at the CERN ISR N84-15912
Search for Hadron jets and large transverse momentum electrons at the SPS pp collider N84-15913
Cross section estimates for multi-TeV physics N84-15914
Monte Carlo simulation of high p/sub P jets N84-15915
The problem of tracking charged particles in the cores of high energy jets in a high rate environment N84-15916
Review of properties of various types of calorimeters: High luminosity and high energy N84-15917
Trigger systems which could operate at a luminosity of 10/sup 33 cm(-2) to sec/sup -1 N84-15918
Searching for limitations in capability due to high average rates N84-15919
Detectors at 20 TeV and detector considerations for a high luminosity hadron-hadron machine N84-15920
The concept of a solid state direct chamber N84-15924
Large area non-crystalline semiconductor detectors N84-15925
Specific heat of He-3 in the Fermi liquid region [DE83-011566] N84-16009
Thermodynamics of aqueous sodium chloride to 823 K and 1 kbar [DE84-001841] N84-16019

CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
Chemical kinetics modeling of engine knock: Preliminary results [DE84-001236] N84-15226
Yield stress of type 21-6-9 stainless steel over a wide range of strain rate (10(-5) to 10-4 s(-1)) and temperature [DE83-017159] N84-15259
Numerical electromagnetics code. Method of moments. User's guide supplement for NEC-3 for modeling buried wires [DE84-002195] N84-15382
Battery lifetime prediction by pattern recognition application to lead-acid battery life-cycling test data [AD-A133281] N84-15397
Numerical solution to the steady state equation of transfer in azimuthally symmetric geometries [DE84-001781] N84-15509
Flywheel energy-management systems for improving fuel economy of motor vehicles [DE84-002340] N84-15688
Response to W. W. Kellogg carbon dioxide and climatic change: Implications for mankind's future [DE84-002723] N84-15737
Efficient large-scale finite-element computations in a CRAY environment [DE83-014946] N84-15818
The 2nd European Conference on Computer Aided Design in Smalland Medium-Size Industries [AD-A129389] N84-15821
Use of 3D graphics in scientific data analysis [DE84-000911] N84-15831
Novette pulse-power-system description [DE83-018185] N84-15968
Problems in astrophysical radiation hydrodynamics [DE84-000185] N84-16102

CALIFORNIA UNIV., LOS ANGELES.
The preparation and properties of porous glass-polymer composite N84-15261
Advanced teleprocessing systems [AD-A133525] N84-15375
Advanced teleprocessing systems [AD-A133554] N84-15377
Advanced teleprocessing systems [AD-A133555] N84-15378
Bifurcations in nonlinear problems of hydrodynamic instability of plane parallel shear flows N84-15411
Neuronal adaptive mechanisms underlying intelligent information processing [AD-A133694] N84-15776
On the relationship between collisionless shock structure and energetic particle acceleration [NASA-CR-175328] N84-15909
The performance of 16000 wire mini-drift MWPC system N84-15922
The harmonic structure of PC 3-4 magnetic pulsations at geosynchronous orbit and its relation to the solar wind N84-16106

CALIFORNIA UNIV., SANTA BARBARA.
Theory of pulse propagation and coherence in free electron [AD-A133334] N84-15544

CALIFORNIA UNIV., SANTA CRUZ.
Optical flux and polarization spectra compared with radio maps of radio galaxies N84-16093
Low-ionization emission regions in the nuclei of spiral galaxies N84-16100

CALSPAN ADVANCED TECHNOLOGY CENTER, BUFFALO, N.Y.
Results from wind tunnel and artificial rainfall tests of the modified scan sensor [AD-A133238] N84-15162

CALSPAN FIELD SERVICES, INC., ARNOLD AIR FORCE STATION, TENN.
Design and initial operational characteristics of a shock tube-Raman scattering calibration system [AD-A133251] N84-15525

CAMBRIDGE UNIV. (ENGLAND).
A method of calculating fully three dimensional inviscid flow through any type of turbomachine blade row N84-15479
A review of current research activity on the aerodynamics of axial flow turbines N84-15480
Three-dimensional flow calculations on a hypothetical steam turbine last stage N84-15481
Wet steam flow in L. P. turbines N84-15483

CANADA INST. FOR SCIENTIFIC AND TECHNICAL INFORMATION, OTTAWA (ONTARIO).
Procedure for producing higher hydrocarbons [NRC/CNR-TT-2073] N84-15217
Measures against errors in the building process [NRC/CNR-TT-2067] N84-15295
On the functional dependence of the freezing point of soils on the composition of water soluble salts in an interstitial solution [NRC/CNR-TT-2070] N84-15707

CARNEGIE-MELLON UNIV., PITTSBURGH, PA.
Automatic inspection for printed wiring [AD-A133328] N84-15566
A distributed control system for the CMU Rover [AD-A133201] N84-15802
The Stanford cart and the CMU Rover [NASA-CR-174502] N84-15803
POPEYE: A gray-level vision system for robotics applications [AD-A133298] N84-15804
The human side of robotics: Results from a prototype study on how workers react to a robot [AD-A133438] N84-15805
Appropriate lengths between phalanges of multijointed fingers for stable grasping [AD-A133448] N84-15806
Implementation of automatic focusing algorithms for a computer vision system with camera control [AD-A133492] N84-15807
Techniques for sensor-based diagnosis [AD-A133297] N84-15814
Exploiting temporal knowledge to organize constraints [AD-A133417] N84-15838
A representation for shape based on peaks and ridges in the difference of low-pass transform [AD-A133299] N84-15849
The travelling salesman problem in graphs with 3-edge cutsets [AD-A133504] N84-15852
ISIS: A constraint-directed reasoning approach to job shop scheduling [AD-A133296] N84-16063

CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO.
Solution of elastic and elasto-plastic problems by the method of lines N84-15573
Electrochemical studies of redox systems for energy storage [NASA-CR-174503] N84-15681

CENTRAL ELECTRICITY GENERATING BOARD, LONDON (ENGLAND).
Influence of Ar + CO2 shielding on the composition of a Cr-Mo-V weld [BLL-CE-TRANS-8000-(9022.09)] N84-15550
Vibration-induced flux variation in the space between two concentric tubes [BLL-CE-TRANS-7949-(9022.09)] N84-15583

CENTRAL ELECTRICITY RESEARCH LABS., LEATHERHEAD (ENGLAND).
Measurements in steam turbines N84-15476
Steam condenser thermal design theories N84-15485

CENTRE D'ESSAIS EN VOL, BRETIGNY-SUR-ORGE (FRANCE).
The man-machine interface in new generation commercial aircraft N84-15096

CENTRE D'ESSAIS EN VOL, ISTRES (FRANCE).
Aircraft operations from airfields with special unconventional characteristics N84-15085

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, GRENOBLE (FRANCE).
Mixed convection and stratification phenomena in liquid metals N84-15488
Studies on sodium boiling phenomena in out of pile rod bundles for various accidental situations in Liquid Metal Fast Breeder Reactors (LMFBR) experiments and interpretations N84-15493
Computation of the thermohydraulics in subassemblies for accident situations N84-15499

CENTRO INFORMAZION' STUDI ESPERIENZE, MILAN (ITALY).
The use of microprocessors for the instrumentation of nondestructive tests [CISE-2072] N84-15571
The use of matrix transducers in medium thickness welding inspection [CISE-2075] N84-15572
The debugging of real time multiprocessor systems: An integrated solution proposal [CISE-2067] N84-15837

CHAMBER OF MINES, JOHANNESBURG (SOUTH AFRICA).
The unique surface properties of gold N84-15310

CHICAGO UNIV., ILL.
Ambiguity and uncertainty in probabilistic inference [AD-A133418] N84-15872

CINCINNATI UNIV., OHIO.
Elevated temperature low cycle fatigue of nickel base superalloys in the conventionally cast, directionally solidified and single crystal forms [AD-A133598] N84-15253
A comprehensive numerical study and experimental verification of endochronic plasticity N84-15579
A thermodynamically consistent constitutive model for inelastic flow of materials N84-15581

CITY UNIV. OF NEW YORK, N. Y.
Low rate transmission of video signals using adaptive delta modulation [AD-A133145] N84-15363

CIVIL AVIATION AUTHORITY, REDHILL (ENGLAND).
The Civil Aircraft Airworthiness Data Recording Programme N84-15079

CLEMSON UNIV., S.C.
Fracture behavior of unidirectional boron/aluminum composite laminates [NASA-CR-3753] N84-15196
The dynamic response characteristics of a viscoelastic beam on periodically-spaced, viscoelastic supports N84-15619
Spinning mode acoustic radiation from the flight inlet [NASA-CR-172273] N84-15896
Sensor control of robot arc welding N84-16047

COAST GUARD RESEARCH AND DEVELOPMENT CENTER, GROTON, CONN.
Analysis of US Coast Guard HU-25A visual and radar detection performance [AD-A133380] N84-15138

COASTAL ENGINEERING RESEARCH CENTER, VICKSBURG, MISS.
Prototype tidal data analysis for Mississippi Sound and adjacent areas [AD-A134071] N84-15744

COLORADO STATE UNIV., FORT COLLINS.
Current collection from the space plasma through defects in high voltage solar array insulation N84-15970

COLORADO UNIV., BOULDER.
Alternative experiments using the geophysical fluid flow cell
[NASA-CR-3766] N84-15706
Line profile variability in winds of OB stars N84-16085

COLORADO UNIV., DENVER.
Increased metabolism and dead space as components of ventilation at high altitude
[AD-A130827] N84-15766
Variable inhibition by falling CO2 of hypoxic ventilatory response in man
[AD-A130658] N84-15768

COLUMBIA UNIV., NEW YORK.
Spatial localization in strabismic observers
[AD-A132748] N84-15784

COMMISSARIAT A L'ENERGIE ATOMIQUE, GIF-SUR-YVETTE (FRANCE).
The performance of 16000 wire mini-drift MWPC system N84-15922

COMMUNICATIONS RESEARCH CENTRE, OTTAWA (ONTARIO).
The Canadian programme of experimental measurement of sea-state characteristics by sky-wave radar N84-15657

COMMUNICATIONS SATELLITE CORP., CLARKSBURG, MD.
Thin N-I-P radiation resistant solar cells
[NASA-CR-168284] N84-15682

COMPUTER SCIENCES CORP., HUNTSVILLE, ALA.
Support for the Naval Research Laboratory Environmental Passive Microwave Remote Sensing Program
[AD-A133330] N84-15526

COMPUTER SOFTWARE MANAGEMENT AND INFORMATION CENTER, ATHENS, GA.
Eleventh NASTRAN User's Colloquium
[NASA-CP-2284] N84-15590
Bolt in bore boundaries N84-15608

CONCORDIA UNIV., MONTREAL (QUEBEC).
Computer graphics techniques for aircraft EMC analysis and design N84-15055

CONNECTICUT UNIV., STORRS.
An algorithm for detecting a change in stochastic process
[AD-A134104] N84-15842

COORDINATING RESEARCH COUNCIL, INC., ATLANTA, GA.
1981 CRC octane number requirement survey
[AD-A133369] N84-15288
1981 CRC (Coordinating Research Council) diesel fuel low-temperature operability field test
[AD-A133543] N84-15289

CORNELL UNIV., ITHACA, N.Y.
A study of the return to isotropy of homogeneous turbulence N84-15110
A lower-upper factored implicit scheme for the numerical solution of the Euler equations applied to arbitrary cascades N84-15111
On 3He bolometer systems
[NASA-CR-175325] N84-15520
An integrated system for shells with discontinuities: Geometric modelling and finite element analysis N84-15576
A periodically forced piecewise linear oscillator N84-15577
Finite element and boundary element analysis of large strain large displacement problems in elastoplasticity N84-15580
Basic vision events
[AD-A132746] N84-15782
Primary events in vision - investigation of basic eye responses
[AD-A132747] N84-15783
Interactions of vibrationally excited molecules with solid surfaces
[AD-A133449] N84-15950
Determination of ionization rates in the principal crystallographic directions in silicon
[AD-A133513] N84-15999

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA (SOUTH AFRICA).
Activities of the National Chemical Research Laboratory
[CSIR-SR-CHEM-261] N84-15188
Analytical chemistry N84-15189
Biological chemistry N84-15190
Corrosion research N84-15191
Inorganic chemistry N84-15192
Precipitation of metals from solutions by baser metals
[CSIR-1712] N84-15242
Observations on the vanadium-nitrogen system and on pure metallic vanadium
[CSIR-TRANS-1708] N84-15243
Advantages of using diamond tools brazed under high vacuum
[CSIR-TRANS-1709] N84-15293
New profilable bond system for diamond and CBN grinding wheels
[CSIR-TRANS-1707] N84-15294

CRANFIELD INST. OF TECH., BEDFORDSHIRE (ENGLAND).
Stiffness changes in unidirectional composites caused by crack systems
[CA-8311] N84-15198
A review of theories currently being used to model steady plane flames on flame-holders
[CA-8316] N84-15218
Second order theory of unsteady burned-anchored flames with arbitrary Lewis number
[CA-8313] N84-15219

CREARE, INC., HANOVER, N.H.
A miniature tilting pad gas lubricated bearing N84-15340

D

DAME (RICHARD E.), SILVER SPRING, MD.
Line-focusing adjustable parabolic splar-concentrating collector
[DE84-001590] N84-15687

DARTMOUTH COLL., HANOVER, N.H.
Periodic spectral variation in Cygnus X-2 and Scorpius X-1 N84-16088

DAYTON UNIV., OHIO.
FOD (Foreign Object Damage) generation by aircraft tires
[AD-A133319] N84-15146
Development of an interactive computer program to produce body description data
[AD-A133720] N84-15822

DEFENCE RESEARCH ESTABLISHMENT VALCARTIER (QUEBEC).
Determination of particle-size distribution by measuring the transmission of an aerosol in sedimentation
[AD-A133288] N84-15962

DEFENCE RESEARCH INFORMATION CENTRE, ORPINGTON (ENGLAND).
Investigations on the reproducibility of the results of drop weight tests by the method of W. S. Pellini
[BLL-DRIC-T-6970-(3623.66)] N84-15517
Welding deformations and residual stresses due to circumferential welding of cylindrical shells and hemispherical end plates
[BLL-DRIC-T-6968-(3623.66)] N84-15549

DEFENSE MAPPING AGENCY, WASHINGTON, D.C.
The future in terrain elevation data processing at the Defense Mapping Agency
[AD-A133483] N84-15641

DEFENSE NUCLEAR AGENCY, WASHINGTON, D.C.
Summary of annual environmental reports for CY 1981: Department of Energy nuclear sites
[DOE/EP-0038/1] N84-15692

DELAWARE UNIV., NEWARK.
Strength theories of continuous and discontinuous fiber composites N84-15195

DENVER RESEARCH INST., COLO.
Artificial intelligence: An analysis of potential applications to training, performance measurement, and job performance aiding
[AD-A133592] N84-15839

DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data
[E84-10068] N84-15637

DEPARTMENT OF ENERGY, ALBUQUERQUE, N. MEX.
Status of research in progress at the Inhalation Toxicology Research Institute
[DE83-012610] N84-15694

DEPARTMENT OF ENERGY, WASHINGTON, D. C.
Energy Materials Coordinating Committee (EMACC). Contractors Meeting on Problems and Opportunities in Structural Ceramics
[CONF-8209111] N84-15266

DESMATICS, INC., STATE COLLEGE, PA.
A note on the analysis of random balance designs
[AD-A133287] N84-15848

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BERLIN (WEST GERMANY).
Periodic flow noise reduction using flow-excited resonators: Theory and application
[DFVLR-FB-83-29] N84-15409

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, BRUNSWICK (WEST GERMANY).
Research towards and development of aerospace vehicle noise certification with emphasis on propeller aircraft and helicopters N84-15026
Flying qualities experiments of rate command/attitude hold systems in the HFB 320 in-flight simulator
[DFVLR-FB-83-25] N84-15163

DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, OBERPFAFFENHOFEN (WEST GERMANY).
Radiative-dynamic properties of Arctic stratus clouds and their possible modification by aerosol particles
[DFVLR-FB-83-23] N84-15740
A minimax theorem for antijamming group codes
[DFVLR-FB-83-30] N84-15879

DIGITAL PROGRAMMING SERVICES, INC., WALTHAM, MASS.
Development of theoretical models and analyses of the micro-physics of cloud and precipitation systems
[AD-A133557] N84-15735

DORNIER-WERKE G.M.B.H., FRIEDRICHSHAFEN (WEST GERMANY).
The lock-on-before-launch weapon delivery and display/control consideration N84-15056
Study on damping representation related to spacecraft structural design
[EMSB-18/83] N84-15182

DOWTY ELECTRONICS LTD., LONDON (ENGLAND).
Automating the testing of software N84-15074

DU PONT DE NEMOURS (E. I.) AND CO., AIKEN, S.C.
Environmental behavior of Technetium-99
[DP-1644] N84-15245
Laboratory robotics at the Savannah River Laboratory
[DE84-001760] N84-15810

DYTEC ENGINEERING, INC., LONG BEACH, CALIF.
Study of noise-certification standards for aircraft engines. Volume 1: Noise-control technology for turbofan engines
[AD-A133386] N84-15157
Study of noise-certification standards for aircraft engines. Volume 2: Procedures for measuring far field sound pressure levels around an outdoor jet-engine test stand
[AD-A133408] N84-15158

E

EAGLE-PICHER CO., JOPLIN, MO.
Calcium-thionyl chloride battery technology
[AD-A133570] N84-15401

ECOLE CENTRALE DE LYON (FRANCE).
Experimental techniques for free edges of turbulent flows N84-15450
Asymmetric turbulent flows N84-15451
The core region of channel flows N84-15452

EDGERTON, GERMESHAUSEN AND GRIER, INC., IDAHO FALLS, IDAHO.
Comparison of fracture-toughness measurements from ferritic-steel compact-tension and surface-flawed specimen
[DE84-000895] N84-15240

EDUCATIONAL TESTING SERVICE, PRINCETON, N. J.
Comparison of IRT observed-score and true-score equatings
[AD-A133871] N84-15791

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND).
Superconducting ground state of a strongly interacting electron system: UBe13
[DE84-001708] N84-16003

ELECTRIC POWER RESEARCH INST., PALO ALTO, CALIF.
Battery lifetime prediction by pattern recognition application to lead-acid battery life-cycling test data
[AD-A133281] N84-15397

ELECTRICITY COUNCIL, LONDON (ENGLAND).
Methods in competition with electroplating
[BLL-OA-TRANS-3037-(6196.3)] N84-15213
Diffusion films produced by heat treatment of electroplated coatings
[BLL-OA-TRANS-3062-(6196.3)] N84-15237
Potentiostatic investigation of the kinetics of the breakdown of the passivity of aluminium in aqueous medium
[BLL-OA-TRANS-3066-(6196.3)] N84-15238
Choice of a melting installation for aluminum alloy
[BLL-OA-TRANS-3095-(6196.3)] N84-15239

ELECTRONIQUE SERGE DASSAULT, ST. CLOUD (FRANCE).
Towards a modularity of software conceived for the requirement of the user N84-15040

ELECTROTECHNICAL LAB., IBARAKI (JAPAN).
Superconducting properties of Nb3Sn multifilamentary wires fabricated by internal tin process
[DE83-018189] N84-16011
ELEKTRONIK-SYSTEM G.M.B.H., MUNICH (WEST GERMANY).
CADAS: A computer aided design tool for avionic systems N84-15065
ELOPTRO AANLEG VAN KENTRON, KEMPTRON PARK (SOUTH AFRICA).
The influence of weakly polarized surfaces on different kinds of thin layer systems N84-15309
ENVIRONMENTAL RESEARCH LAB., ATHENS, GA.
Increased confidence in spectrum matching by use of a retention time library
[PB83-232090] N84-15229
ESSEX CORP., HUNTSVILLE, ALA.
Space telescope
[NASA-CR-170948] N84-16097
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA (SWITZERLAND).
The performance of 16000 wire mini-drift MWPC system N84-15922
EUROPEAN SPACE AGENCY, PARIS (FRANCE).
Fluid thermodynamics
[ESA-TT-778] N84-15512
Study of the onboard calibration equipment of the HRV camera
[ESA-TT-794] N84-15529
Explicit second order splitting schemes for solving hyperbolic nonlinear problems: Theory and application to transonic flow
[ESA-TT-768] N84-15855
Stationary stochastic processes
[ESA-TT-812] N84-15875
EUROPEAN SPACE AGENCY, TOULOUSE (FRANCE).
The European Space Agency's Earth observation satellite programmes N84-15647

F

FEDERAL AVIATION ADMINISTRATION, OKLAHOMA CITY, OKLA.
Job attitudes toward the new maintenance concept of the airway facilities service
[AD-A133282] N84-15793
FEDERAL AVIATION ADMINISTRATION, WASHINGTON, D.C.
Census of US Civil aircraft. Calendar year 1982
[AD-A133161] N84-15033
Advanced automation program. Program master plan
[DOT/FAA/AP-83/3] N84-15139
Establishment and discontinuance criteria for airport traffic control towers
[AD-A133461] N84-15141
Inhalation toxicology. 3: Evaluation of thermal degradation products from aircraft and automobile engine oils, aircraft hydraulic fluid, and mineral oil
[AD-A133221] N84-15778
Color perception and ATC job performance
[AD-A132649] N84-15781
Rate of initial recovery and subsequent radar monitoring performance following a simulated emergency involving startle
[AD-A133602] N84-15795
Airport noise control strategies
[AD-A133137] N84-15900
FERMI NATIONAL ACCELERATOR LAB., BATAVIA, ILL.
Magnetic-field considerations in superferric dipole
[DE84-002573] N84-15892
Breakdown processes in wire chambers, prevention and rate capability N84-15923
High energy electromagnetic shower position measurement by a fine grained scintillation hodoscope N84-15928
A measurement of the response of an SCG1-C scintillation glass shower detector to 2-17.5 GeV positrons N84-15930
FLIGHT SAFETY FOUNDATION, INC., ARLINGTON, VA.
Two decades of air carrier jet operation N84-15080
FLORIDA UNIV., GAINESVILLE.
Electrically controlled coloration of materials
[AD-A133420] N84-15223
FONDAZIONE UGO BORDONI, ROME (ITALY).
Activities report in communications research performed in cooperation with Higher Institute for Posts and Telegraph (ISPT) N84-15384
Spread spectrum transmission. Part 1: General characteristics
[FUB-49-1982-PT-1] N84-15385
The small transmitter receiver stations in the Sirio experiment
[FUB-50-1982] N84-15386
Statistic prediction techniques of rain attenuation starting from pluviometric statistics
[FUB-51-1982] N84-15387
Maximum entropy linear prediction method
[FUB-48-1982] N84-15857
Linear prediction methods
[FUB-52-1982] N84-15858
Geometric methods for linear prediction
[FUB-54-1982] N84-15859
FULMER RESEARCH INST. LTD., STOKE POGES (ENGLAND).
Field emission electric propulsion: Additional propellants: Further tests on indium and alloys
[R864] N84-15186
Radiation effects in the Joint European Torus Experiment: Guidelines for preliminary design
[R857/2] N84-15971
FUNDACAO CALOUSTE GULBENKIAN, LISBON (PORTUGAL).
Elements of functions of a complex variable N84-15881

G

GAERTNER (W. W.) RESEARCH, INC., STAMFORD, CONN.
Multispectral Data Processing System (MDPS)
[AD-A133426] N84-15816
GARRETT TURBINE ENGINE CO., PHOENIX, ARIZ.
Low-cost single-crystal turbine blades, volume 1
[NASA-CR-168218] N84-15247
GATES LEARJET CORP., DENVER, COLO.
Determination of elevator and rudder hinge forces on the Learjet model 55 aircraft N84-15604
GENERAL DYNAMICS CORP., FORT WORTH, TEX.
System architecture: Key to future avionics capabilities N84-15035
A video bus for weapon system integration N84-15051
Integration of ICNIA into advanced high performance fighter aircraft N84-15059
Color display technology in advanced fighter cockpits N84-15061
Lessons learned in the development of the F-16 flight control system N84-15092
TAS: A Transonic Aircraft/Store flow field prediction code
[NASA-CR-3721] N84-15114
GENERAL ELECTRIC CO., CINCINNATI, OHIO.
Clean catalytic combustor program
[NASA-CR-168323] N84-15151
Aerothermal modeling. Executive summary
[NASA-CR-168330] N84-15152
Aerothermal modeling, phase 1. Volume 1: Model assessment
[NASA-CR-168296-VOL-1] N84-15155
Aerothermal modeling, phase 1. Volume 2: Experimental data
[NASA-CR-168296-VOL-2] N84-15156
Broad specification fuels combustion technology program
[NASA-CR-168179] N84-15283
GENERAL ELECTRIC CO., PHILADELPHIA, PA.
Copper vapor laser scale demonstration
[AD-A133327] N84-15543
GENERAL ELECTRIC CO., SYRACUSE, N.Y.
Extraterrestrial radio noise and its effect on radar performance N84-15662
GENERAL MOTORS CORP., INDIANAPOLIS, IND.
Advanced Gas Turbine (AGT) technology development
[NASA-CR-168235] N84-15554
GENOA UNIV. (ITALY).
Turbine aerodynamic design using through-flow theory. Meridional through-flow calculation N84-15474
GEO-CENTERS, INC., NEWTON, MASS.
Evaluation of radiation damage to Metal-Oxide-Semiconductor (MOS) devices
[AD-A133593] N84-16002
GEORGE WASHINGTON UNIV., WASHINGTON, D.C.
Static and dynamic stiffness reduction of graphite/epoxy composite laminates under fatigue loading N84-15194
Research in some applied, and the modelling aspects of, reliability theory
[AD-A133424] N84-15567
The parabolic approximation for sound propagation in stratified moving media N84-15893
GEORGIA INST. OF TECH., ATLANTA.
Combustion at the interface of an oxidizer-fuel slab system N84-15215
Computation of steady internal flows using integral representation methods with finite series expansions N84-15418
An assumed deviatoric stress-velocity-pressure mixed finite element method for unsteady convective, incompressible viscous flow N84-15420
Far Infrared Radiometric Spectrometer (FIRRS)
[AD-A133552] N84-15527
Nonlinear analysis of thin shells by the hybrid mixed finite-element method N84-15578
Mechanical property characterization of F-100/934 graphite-epoxy composite material N84-16031
GHENT UNIV. (BELGIUM).
Iterative techniques for the solution of elliptic finite difference equations N84-15435
Iterative solution of the finite difference potential equations for subsonic and transonic flows N84-15436
GRUMMAN AEROSPACE CORP., BETHPAGE, N.Y.
A wing concept for supersonic maneuvering
[NASA-CR-3763] N84-15115
Mach 0.6 to 3.0 flows over rectangular cavities
[AD-A134579] N84-15121
Implementation of elastic-plastic structural analysis into NASTRAN N84-15606
GTE SYLVANIA, INC., NEEDHAM HEIGHTS, MASS.
Bidirectional fiber optic cable adapter
[AD-A133371] N84-15370

H

HANFORD ENGINEERING DEVELOPMENT LAB., RICHLAND, WASH.
Design and use of nonstandard tensile specimens for irradiated materials testing
[DE84-001468] N84-15254
Use of the disk bend test to assess irradiation performance of structural alloys
[DE84-001484] N84-15255
Ultrasonic test data acquisition and defect verification of stainless steel welds at 4000 deg F
[DE83-012146] N84-15570
Miniature center-cracked-tension specimen for fatigue crack growth testing
[DE84-001470] N84-15615
HANSEN (R. G.) AND ASSOCIATES, SANTA BARBARA, CALIF.
Testing and characterizations of infrared sensor over the temperature range of 2 Kelvin to 300 Kelvin N84-15347
Suitability of commercially available laboratory cryogenic refrigerators to support shipboard electro-optical systems in the 10 - 77 Kelvin region N84-15355
HARVARD UNIV., CAMBRIDGE, MASS.
Baroclinic instability of atmospheric jets N84-15704
The causation and variability of the northern winter quasi-stationary planetary waves N84-15705
The role of microorganisms in marine corrosion processes
[AD-A133113] N84-15757
Optical and X-ray selected samples of quasars: Evolution of the luminosity distributions N84-16090
Aperture synthesis observations of star forming regions: Compact H2 regions and masers N84-16092
Some issues related to evolution of planetary atmospheres N84-16103
Transport processes in planetary atmospheres N84-16104
HAWAII UNIV., MANOA.
Influences on group productivity. 2: Factors inherent in the person. A bibliographic synopsis
[AD-A131015] N84-15790
HELIONETICS, INC., SAN DIEGO, CALIF.
Beam processing for high-efficiency Si solar cells
[DE84-002059] N84-15690
HOUSTON UNIV., TEX.
Effects of hydrogen on strength and ductility of tantalum N84-15260
Millimeter wave guiding structures and antennas
[AD-A133528] N84-15376
HUFFMAN (PAUL R.), INC., PEMBERVILLE, OHIO.
Recycling the kinetic energy of an automobile
[DE83-004201] N84-15551
HUGHES AIRCRAFT CO., EL SEGUNDO, CALIF.
Chemistry, characterization and processing of IMC curing polymers
[AD-A133479] N84-15274
Computer program for analysis of split-Stirling-cycle cryogenic coolers N84-15344
HUGHES RESEARCH LABS., MALIBU, CALIF.
Study of phase diagrams of ternary semiconductors
[AD-A133556] N84-16000
HULBURT (E. O.) CENTER FOR SPACE RESEARCH, WASHINGTON, D.C.
Determination of propagation limitations at HF by real-time update of a computer model from oblique sounder data N84-15660
On the utilization of ionospheric diagnostics in the single-site location of HF emitters N84-15661

HUMAN PERFORMANCE RESEARCH, INC., GOLETA, CALIF.
Computer based landing signal officer carrier aircraft recovery model
[AD-A133507] N84-15808
HYDRAULIC RESEARCH TEXTRON, VALENCIA, CALIF.
A study of digitally controlled flight control actuation
[AD-A133274] N84-15160

I

ILLINOIS UNIV., CHICAGO.
An experimental study of steady and pulsating heat transfer in curved tubes N84-15515
A three-dimensional photoelastic investigation of stresses and cracks formed in concrete around deformed reinforcing bars N84-15621
The 2-stage selection procedures based on tests
[AD-A133405] N84-15871
ILLINOIS UNIV., URBANA.
Rapid solidification processing and powder metallurgy of Al alloys
[AD-A133873] N84-15250
Analysis of short pulse laser altimetry data obtained over horizontal path
[NASA-CR-170612] N84-15535
Remote sensing of atmospheric pressure and sea state from satellites using short-pulse multicolor laser altimeters N84-15674
ILLINOIS UNIV., URBANA-CHAMPAIGN.
Polymer characterization by electrohydrodynamic ionization mass spectrometry: Probing composition and chemistry of mixtures in solution N84-15264
Studies in unsteady penetrative thermal convection N84-15422
The effect of turbulent atmosphere on backscattered waves N84-15664
Middle latitude forcing of a model tropical atmosphere with horizontally nonuniform basic states N84-15724
Ambipolar diffusion in interstellar clouds: One-dimensional, isothermal collapse N84-16099
The interstellar medium along the line of sight toward X Per N84-16101
IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
Introduction to turbulent shear flows N84-15449
INDIAN INST. OF SCIENCE, BANGALORE.
Fourier optics for the Maxwell field: Formalism and applications
[DE84-002845] N84-15383
INDIANA UNIV., BLOOMINGTON.
Theoretical and experimental studies of the electronic structure of the Mo3(Micro3-0)(Micro3-OR)(Micro-OR)3(OR)6 type of triangulo metal atom cluster compound
[AD-A133516] N84-15951
Jet-impact nebulization for sample introduction in inductively coupled plasma spectrometry
[AD-A133152] N84-15982
INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL.
High-temperature molten salt thermal energy storage systems for solar applications
[NASA-CR-167916] N84-15679
USAF advanced terrestrial energy study. Volume 2: Technology handbook
[AD-A133272] N84-15684
USAF advanced terrestrial energy study. Volume 3: Parameter survey
[AD-A133501] N84-15685
USAF advanced terrestrial energy study. Volume 4: Analysis, data, and bibliography
[AD-A133514] N84-15686
INSTITUTE OF SPACE AND ASTRONAUTICAL SCIENCE, TOKYO (JAPAN).
Flow visualization and LDV measurement of turbulent mixing layers
[REPT-606] N84-15424
Synthesis of insensitive controllers in linear quadratic control problems
[REPT-605] N84-15841
Fine pointing control of the solar UV telescope on the sounding rocket S-520-5
[ISAS-608] N84-16094
INSTITUTO NACIONAL DE TECNICA AEROESPACIAL, ESTEBAN TERRADAS, TORREJON DE ARDOZ (SPAIN).
Ice formation in aircraft N84-15130
Status of fiber reinforced materials N84-15209
The influence of the environment on the mechanical characteristics of composite materials: Design considerations
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Computer science and technology: Future information processing technology, 1983
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IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES.
A comparison study of the energetics of standing and transient eddies between two general circulation models: The GLAS Climate Model and the NCAR Community Climate Model N84-15726
IRT CORP., SAN DIEGO, CALIF.
Proton electrostatic analyzer
[AD-A133588] N84-15528
Experimental studies of secondary ion emission from well-characterized surfaces
[AD-A133186] N84-15943

J

JACKSON STATE UNIV., MISS.
A preliminary survey of plankton and periphyton in the Turn Barge Canal and basin area of Kennedy Space Center, Florida N84-16027
JAYCOR, ALEXANDRIA, VA.
Elliptic solvers for NORDA ocean models and a quasi-geostrophic regional eddy-mean energetics package
[AD-A133754] N84-15751
Results from a two-layer and a reduced gravity model of the Alboran Sea; and vertical shear from tops
[AD-A133753] N84-15752
JEPPSON (MORRIS R.), CARMEL, CALIF.
Microwave methods and apparatus for paving and paving maintenance
[DE84-016306] N84-15359
JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
JPL closeup
[NASA-CR-175324] N84-15168
Optimal design of gas adsorption refrigerators for cryogenic cooling N84-15348
A general computer model for predicting the performance of gas sorption refrigerators N84-15349
LaNi5 hydride cryogenic refrigerator test results N84-15350
Cascade Joule-Thomson refrigerators N84-15354
Maser cavity servo-tuning system
[NASA-CASE-NPO-15890-1] N84-15536
Discharge cell for optogalvanic spectroscopy having orthogonal relationship between the probe laser and discharge axis
[NASA-CASE-NPO-16271-1] N84-15537
Remote sensing with spaceborne synthetic aperture imaging radars: A review N84-15648
JOINT RESEARCH CENTRE OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY).
Thermohydraulics in liquid metals N84-15491
Liquid metal experimental facilities N84-15492

K

KANSAS UNIV., LAWRENCE.
Analysis of nonplanar wing-tip mounted lifting surfaces on low-speed airplanes N84-15142
Theoretical and software considerations for nonlinear dynamic analysis
[NASA-CR-174504] N84-15589
Radar and infrared remote sensing of terrain, water resources, arctic sea ice, and agriculture N84-15651
Computer control of a seven degree of freedom manipulator arm N84-16051
KELLOGG COMMUNICATIONS CORP., LITTLETON, COLO.
Computer science and technology: Future information processing technology, 1983
[PB83-257618] N84-15820
KENTUCKY UNIV., LEXINGTON.
A feasibility study of electromagnetic DE-spin system for Earth orbiting satellites N84-16040
KERNFORSCHUNGSANLAGE, JUELICH (WEST GERMANY).
Quantitative sputter profiling at surfaces and interfaces N84-15314
KERNFORSCHUNGSZENTRUM, KARLSRUHE (WEST GERMANY).
Temperature distributions, boiling and dry-out behind local blockages N84-15495
Sodium boiling experiments in bundle geometries under fast transient and steady state conditions N84-15496
The BLOW-3A: A theoretical model to describe transient two phase flow conditions in Liquid Metal Fast Breeder Reactor (LMFBR) coolant channels N84-15497
Theoretical simulation of thermohydraulic behavior of sodium cooled subassemblies in steady state and transient conditions N84-15498
KMS FUSION, INC., ANN ARBOR, MICH.
A low loss quasioptical cavity for a two-stage Free Electron Laser (FEL)
[AD-A133321] N84-15541
Limiting energy spread at high laser intensities using phase space displacement
[AD-A133322] N84-15542
Two-stage FEL (Free Electron Laser) program
[AD-A133508] N84-15546
KORSCH OPTICS, INC., HUNTSVILLE, ALA.
Technical support for AXAF
[NASA-CR-170950] N84-15959
KYOTO UNIV. (JAPAN).
Collisional-radiative model for helium-like ions: Application to intermediate-density plasmas
[IPPJ-647] N84-15976

L

LABORATOIRE CENTRAL DE TELECOMMUNICATIONS, PARIS (FRANCE).
Multiple paths on the ocean surface N84-15666
LABORATOIRE D'ETUDE DES TRANSMISSIONS IONOSPHERIQUES, CACHAN (FRANCE).
Adaptive protection of detecion systems operating by spread spectrum N84-15652
Contending with jamming in decametric waves in an adaptive system of all-directional antennas N84-15653
LAMONT-DOHERTY GEOLOGICAL INST., PALISADES, N. Y.
Geophysical data from drifting ice stations FRAM 4 and TRISTEN
[AD-A133370] N84-15640
Climate-chemistry connection
[DE84-001950] N84-15739
LEIDEN UNIV. OBSERVATORY (NETHERLANDS).
Computational methods for ideal compressible flow N84-15462
LETTERMAN ARMY INST. OF RESEARCH, SAN FRANCISCO, CALIF.
Acute intramuscular toxicity (LD50) of 1,1'-trimethylenebis (4-(Hydroxyiminomethyl) pyridinium bromide) monohydrate, (TMB-4) in male mice
[AD-A133148] N84-15758
LEYBOLD-HERAEUS G.M.B.H., COLOGNE (WEST GERMANY).
Gifford-McMahon refrigerator with split cold head N84-15346
LIEGE UNIV. (BELGIUM).
Finite difference methods for convective-diffusive equations N84-15432
The accuracy of the finite difference computations of recirculating free convective flows N84-15471
LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
Earth coverage corrugated horns (44.5 GHz and 20.7 GHz)
[AD-A133241] N84-15366
Distributed sensor network
[AD-A133250] N84-15903
LITTLE (ARTHUR D.), INC., CAMBRIDGE, MASS.
Computer science and technology: Future information processing technology, 1983
[PB83-257618] N84-15820
LOCKHEED-GEORGIA CO., MARIETTA.
Orthotropic hole element N84-15595
LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
Investigation of a para-ortho hydrogen reactor for application to spacecraft sensor cooling
[NASA-CR-175131] N84-15957
LOGISTICS MANAGEMENT INST., WASHINGTON, D. C.
Local automation model: Functional description
[AD-A133389] N84-16077
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Production and characterization of beta-silicon carbide and alpha-silicon nitride whiskers for ceramic matrix composites
[LA-9650-MS] N84-15197
Equation of state for the detonation products of several simple explosives
[DE83-017266] N84-15290
LARC: Computer codes for Lagrangian analysis of stress-guage data to obtain decomposition rates through correlation to thermodynamic variables
[DE84-002404] N84-15292
The theory of an active magnetic regenerative refrigerator N84-15351
Fabrication of a hermetically sealed connector
[DE84-002322] N84-15402
Nanosecond image-shuttering studies at Los Alamos National Laboratory
[DE84-001733] N84-15405

Optical diagnostics for condensed-phase shock-compressed molecular systems
[DE84-001172] N84-15510
Two-phase flow studies
[DE84-001727] N84-15511
Application of two-dimensional discrete-ordinates methods to multiple scattering of laser radiation
[AD-A133258] N84-15539
Numerical experiments with CONCHAS-SPRAY: Compression stroke of an external chamber diesel engine
[DE84-002321] N84-15561
Numerical simulations of convectively excited gravity waves
[DE84-001867] N84-15718
Microinstabilities in the high latitude F region: A brief review
[DE84-001709] N84-15719
Numerical methods for tracking interfaces
[DE84-001730] N84-15854
Scattering and absorption of light by soot particles
[DE84-002308] N84-15967
A new numerical method for the transient gas-dyanmic code EVENT
[LA-9594-MS] N84-15977
A multipurpose production controller for plasma physics codes
[LA-9477-MS] N84-15978
Superconducting ground state of a strongly interacting electron system: UBe13
[DE84-001708] N84-16003
Structural studies at elevated pressure and reduced temperatures using synchrotron radiation: Application to Ce.8La.1Th.1
[DE84-001793] N84-16007
Electron-electron interactions and broken symmetry in one dimension
[DE84-001704] N84-16014
Processing time using Datatrieve-11, clunks, and FORTRAN
[DE84-001708] N84-16081
Energy distributions and yields of secondary ions and electrons emitted by GIOTTO during Halley encounter
[DE84-001661] N84-16105

LOUISIANA STATE UNIV., BATON ROUGE.
Computer-Aided Structural Engineering (CASE) project. Reference manual: Computer graphics program for generation of engineering geometry (SKETCH)
[AD-A133493] N84-15828

LOWELL UNIV., MASS.
Synthesis and characterization of some thermotropic nematic and cholesteric polymers N84-15262
Automatic electron density profiles from digital ionograms N84-15659

M

MAGNAVOX GOVERNMENT AND INDUSTRIAL ELECTRONICS CO., MAHWAH, N. J.
Split-Stirling, linear-resonant, cryogenic refrigerators for detector cooling N84-15342

MARCONI AVIONICS LTD., ROCHESTER (ENGLAND).
Certification experience of the Jaguar fly-by-wire demonstrator aircraft integrated flight control system N84-15095

MARCONI CO. LTD., CHELMSFORD (ENGLAND).
Ocean wave imaging by SAR N84-15649

MARCONI CO. LTD., GREAT BADDOW (ENGLAND).
A long range propagation experiment to investigate the incidence of anomalous propagation in the north Atlantic N84-15669

MARYLAND UNIV., BALTIMORE.
Fitting a multiple regression function
[AD-A133482] N84-15874

MARYLAND UNIV., COLLEGE PARK.
Analysis of data flow for SIMD (Single Instruction Multiple Data) systems
[AD-A133248] N84-15812
TOF for heavy stable particle identification N84-15936
The effects of space charge on ionic mobility measurements in cylindrical geometries N84-15993

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Mission definition study for a VLBI station utilizing the Space Shuttle
[NASA-CR-175126] N84-15173
Asymptotic analysis of numerical wave propagation in finite difference equations
[NASA-CR-175323] N84-15360
Dynamic control of session input rates in communication networks
[AD-A133572] N84-15379
Input-output characterization of an ultrasonic testing system by digital signal analysis
[NASA-CR-3756] N84-15565
Plane strain fracture toughness of polyethylene pipe materials
[MIT-RR-R2-2] N84-15586
Growth processes of snow
[AD-A133136] N84-15639
Visual routines
[AD-A133634] N84-15792
Efficient demand-driven evaluation
[AD-A133477] N84-15827
Analyzing the roles of descriptions and actions in open systems
[AD-A133614] N84-15878
The numerical synthesis and inversion of acoustic fields using the Hankel transform with application to the estimation of the plane wave reflection coefficient of the ocean bottom
[AD-A133156] N84-15901
Project objectives and progress at the Research Laboratory of Electronics
[RLE-125] N84-16016
A mercuric detector system for X-ray astronomy. 2. Results from flight tests of a balloon borne instrument
[NASA-CR-175329] N84-16095
Development of a mercuric iodide solid state spectrometer for X-ray astronomy
[NASA-CR-175330] N84-16096

MASSACHUSETTS UNIV., AMHERST.
Application of the Gibbs distribution to image segmentation
[AD-A133406] N84-15850

MATERIALS RESEARCH LABS., ASCOT VALE (AUSTRALIA).
Permeability of flexible materials used in fuel storage tanks. Part 2: A method of measurement and preliminary results
[AD-A133451] N84-15558

MAX-PLANCK-INSTITUT FUER STROEMUNGSFORSCHUNG, GOETTINGEN (WEST GERMANY).
Transonic noise generation by duct and profile flow
[AD-A129367] N84-15899

MCDONNELL AIRCRAFT CO., ST. LOUIS, MO.
Advanced F/A-18 avionics N84-15048
Avionics fault tree analyzer N84-15053

MCDONNELL-DOUGLAS ASTRONAUTICS CO., HUNTINGTON BEACH, CALIF.
Development of a consensus standard for determining thermal performance of high-concentration-ratio solar collectors
[DE83-005129] N84-15676

MCDONNELL-DOUGLAS CORP., ST. LOUIS, MO.
NASA/MSFC NASTRAN auxiliary I/O routines N84-15592

MCDONNELL-DOUGLAS RESEARCH LABS., ST. LOUIS, MO.
Laser radar analyses
[AD-A133295] N84-15540

MCELROY (RALPH) CO., AUSTIN, TEX.
Process for isotope separation
[DE84-001983] N84-15507

MCGILL UNIV., MONTREAL (QUEBEC).
High energy electromagnetic shower position measurement by a fine grained scintillation hodoscope N84-15928
A measurement of the response of an SCG1-C scintillation glass shower detector to 2-17.5 GeV positrons N84-15930

MECHANICAL TECHNOLOGY, INC., ALBANY, N.Y.
Split-Stirling-cycle displacer linear-electric drive N84-15343

MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., MUNICH (WEST GERMANY).
Increasing significance of electromagnetic effects in modern aircraft development N84-15041
Concept of a fighter aircraft weapon delivery system N84-15064
Concepts for avionic and weapon integration facilities N84-15070
Software testing of safety critical systems N84-15073
Tornado autopilot measures to ensure survivability after failures N84-15094
New flight deck design in the light of the operational capabilities N84-15097

MIAMI UNIV., FLA.
Magnetic anomalies in east Pacific using MAGSAT data
[E84-10060] N84-15630

MICHIGAN STATE UNIV., EAST LANSING.
A modular twin bus microprocessor system for laboratory automation
[AD-A133372] N84-15815

MICHIGAN UNIV., ANN ARBOR.
Nonlinear inverse perturbation method in dynamic redesign N84-15107
Asymptotic theory of an unseparated supersonic turbulent boundary layer at a compression corner N84-15112
Design, construction, and use of a high-resolution, two-component LDA N84-15419
Plastic flows of tubes and blocks N84-15421
Heat generation in aircraft tires under braked rolling conditions
[NASA-CR-3768] N84-15587
Vacuum ultraviolet photofragmentation of H2O and NO2: Laboratory studies and atmospheric applications N84-15703
Scintillation chamber operation of calorimters for colliding beam detectors N84-15927
The perceptual component of relationships in library networks N84-16070

MIDDLE TENNESSEE STATE UNIV., MURFREESBORO.
A report on superfluid helium flow through porous plugs for space science applications N84-16043
Population control of self-replicating systems: Option C N84-16044

MIDWEST RESEARCH INST., GOLDEN, COLO.
New polyconjugated oxidation-reduction polymers, as well as a method and apparatus for electrochemical regeneration
[DE84-002813] N84-15276
Evaluation of air-cooled central receivers
[DE83-005130] N84-15423
Direct steam generation in line-focus solar collectors
[DE83-006030] N84-15678
The SERI advanced and innovative wind energy concepts program
[DE83-011960] N84-15680
Determination of freeze protection heat loss from a parabolic trough solar system
[DE84-000005] N84-15689
Progress in polycrystalline thin-film solar cells
[DE83-012131] N84-15691
Aerodynamic sources of acoustic radiation from a single MOD-2 wind turbine
[DE84-000013] N84-15905

MIDWEST RESEARCH INST., KANSAS CITY, MO.
Appraisal of scientific resources for emergency management
[AD-A133285] N84-16062

MINISTRY OF DEFENCE, LONDON (ENGLAND).
Some comments on the hazards associated with manoeuvring flight in severe turbulence at high speed and low altitude N84-15089

MINNESOTA UNIV., MINNEAPOLIS.
Sputtering of multicomponent materials N84-15312

MISSION RESEARCH CORP., ALBUQUERQUE, N. MEX.
Beam propagation experimental study
[AD-A133310] N84-15946

MISSISSIPPI STATE UNIV., STATE COLLEGE.
Preliminary designs for modifications to the X-ray source and beam monitor of the Marshall Space Flight Center's X-ray Calibration Facility N84-16032
An evaluation of Techroll seal flexible joint material N84-16037

MISSOURI UNIV., KANSAS CITY.
Optical properties of natural minerals and other materials in the 350-50000 cM-1 spectral region
[AD-A133530] N84-15965

MITRE CORP., BEDFORD, MASS.
Efficient utilization of the DRAMA service channel
[AD-A133286] N84-15368

MMR TECHNOLOGIES, INC., MOUNTAIN VIEW, CALIF.
Low cost microminiature refrigerators for large unit volume applications N84-15356

MOTOROLA, INC., CARLISLE, PA.
Manufacturing technology for high quality swept-culture growth quartz
[AD-A133500] N84-15998

MOUND LAB., MIAMISBURG, OHIO.
Quantitative determination of hydrogen by pulsed nuclear magnetic resonance spectroscopy
[DE84-002831] N84-15227

MUENSTER UNIV. (WEST GERMANY).
Secondary ion emission from adsorbate layers on polycrystalline Ni N84-15306

N

NAGOYA UNIV. (JAPAN).
Dissipation of magnetic energy during disruptive current termination
[IPPJ-644] N84-15973
Extraction of volume produced H(-) or D(-) ions from a sheet plasma I
[IPPJ-645] N84-15974
Non-stochastic acceleration of protons in the magnetic neutral sheet
[IPPJ-646] N84-15975

NATAL UNIV., PIETERMARITZBURG (SOUTH AFRICA).
Etching of defects on crystal surfaces N84-15300
NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.
Effective use of earthquake data
[AD-A134077] N84-15712
NATIONAL AERONAUTICAL ESTABLISHMENT, OTTAWA (ONTARIO).
The use of flight recorders in the investigation of aircraft mishaps N84-15076
Capabilities of the NRCC/NAE flight impact simulator facility
[AD-A130849] N84-15136
Unsteady pressure and force measurements associated with transonic buffeting of a two-dimensional supercritical airfoil
[AD-A133139] N84-15503
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.
Wind tunnel investigations of glider fuselages with different waistings and wing arrangements N84-15116
Three-dimensional effects on airfoils
[NASA-TM-77025] N84-15118
Helicopter blade tips
[NASA-TM-77370] N84-15119
Flow mechanism and experimental investigation of a rotating stall in transonic compressors
[NASA-TM-77373] N84-15122
New investigation of short wings with lateral jets
[NASA-TM-77347] N84-15124
Recognizing defects in carbon-fiber reinforced plastics
[NASA-TM-76947] N84-15143
Fuel economy in aviation
[NASA-SP-462] N84-15144
Trichite growth during oxidation of titanium and TA6V4 alloy by water vapor at high temperatures
[NASA-TM-76974] N84-15248
Screening and classification of ceramic powders
[NASA-TM-77092] N84-15270
Recording and reproduction of microwave holograms using a scanning procedure and their subsequent optical processing
[NASA-TM-77349] N84-15519
Design procedures for compressor blades
[NASA-TM-77085] N84-15552
Experimental determination of gap flow-conditioned forces at turbine stages and their effect on the running stability of simple rotors
[NASA-TM-77293] N84-15553
Nonuniformity of the Earth's rotation and the motion of the poles
[NASA-TM-77337] N84-15709
Aerospace medicine and biology: A continuing bibliography with indexes (supplement 252)
[NASA-SP-7011(252)] N84-15763
A study on airborne integrated display system and human information processing
[NASA-TM-77338] N84-15789
Thermal and electrical interaction of tantalum with a low temperature chemically active plasma flow
[NASA-TM-77374] N84-15980
Computations of the current profile influence on tearing instability
[NASA-TM-77285] N84-15981
A guide to research in NASA history, 7th edition
[NASA-TM-85486] N84-16076
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.
Design, development and flight test of a demonstration advanced avionics system N84-15067
Incident reporting: Its role in aviation safety and the acquisition of human error data N84-15081
Pilot human factors in stall/spin accidents of supersonic fighter aircraft N84-15102
AFTI/F-16 flight test results and lessons
[NASA-TM-84920] N84-15159
Phosphorous-containing imide resins
[NASA-CASE-ARC-11368-3] N84-15202
A helium-3 refrigerator employing capillary confinement of liquid cryogen N84-15353
Numerical computation of transonic flow governed by the full-potential equation N84-15469
Preflight transient dynamic analyses of B-52 aircraft carrying Space Shuttle solid rocket booster drop-test vehicle
[NASA-TM-84925] N84-15588
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. EARTH RESOURCES LABS., BAY ST. LOUIS, MISS.
A correlation analysis of percent canopy closure versus TMS spectral response for selected forest sites in the San Juan National Forest, Colorado
[E84-10066] N84-15635
Analysis of data acquired by synthetic aperture radar over Dade County, Florida, and Acadia Parish, Louisiana
[E84-10067] N84-15636
Classification and area estimation of land covers in Kansas using ground-gathered and LANDSAT digital data
[E84-10068] N84-15637
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Refrigeration for Cryogenic Sensors
[NASA-CP-2287] N84-15327
NASA needs and trends in cryogenic cooling N84-15329
Design of an adiabatic demagnetization refrigerator for studies in astrophysics N84-15352
Analysis of a high-frequency Stirling Cycle compressor for cryogenic cooling in space
[NASA-TM-85066] N84-15555
A NASTRAN DMAP procedure for calculation of base excitation modal participation factors N84-15599
Spectral characterization of the LANDSAT thematic mapper sensors
[E84-10065] N84-15634
Remote sensing of atmospheric pressure and sea state from satellites using short-pulse multicolor laser altimeters N84-15674
Pilot climate data system: A state-of-the-art capability in scientific data management
[NASA-TM-85115] N84-15731
Thermal electron heating rate: A derivation
[NASA-TM-85124] N84-15941
Comment on the extinct paradox
[NASA-TM-85113] N84-15958
Optical multiple sample vacuum integrating sphere
[NASA-CASE-GSC-12849-1] N84-15960
Decimetric gyrosynchrotron emission during a solar flare
[NASA-TM-85123] N84-16107
Turbulent heating in solar cosmic ray theory
[NASA-85074] N84-16108
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. JOHN F. KENNEDY SPACE CENTER, COCOA BEACH, FLA.
Video processor for air traffic control beacon system
[NASA-CASE-KSC-11155-1] N84-15395
Chronology of KSC and KSC related events for 1981
[NASA-TM-85510] N84-16080
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.
Flow improvements in the circuit of the Langley 4- by 7-meter tunnel
[NASA-TM-85662] N84-15117
Loads and aeroelasticity division research and technology accomplishments for FY 1982 and plans for FY 1983
[NASA-TM-84594] N84-15120
Design considerations for remotely piloted, high-altitude airplanes powered by microwave energy
[NASA-TM-85730] N84-15145
An alternate concept for expanding man's presence in space
[NASA-TM-84617] N84-15172
Capture-ejector satellites
[NASA-TM-85686] N84-15179
Mechanical fastener
[NASA-CASE-LAR-12738-2] N84-15180
Analysis of local delaminations and their influence on composite laminate behavior
[NASA-TM-85728] N84-15199
User's manual for GAMNAS: Geometric and Material Nonlinear Analysis of Structures
[NASA-TM-85734] N84-15200
Analysis of interlaminar stresses in thick composite laminates with and without edge delamination
[NASA-TM-85738] N84-15201
Hot melt recharge system
[NASA-CASE-LAR-12881-2] N84-15271
Thermal analysis research applicable to space station technology needs
[NASA-TM-84658] N84-15426
Low X-ray absorption aneurism clips
[NASA-CASE-LAR-12650-2] N84-15764
Status of research at the Institute for Computer Applications in Science and Engineering (ICASE)
[NASA-CR-172267] N84-15811
Spinning mode acoustic radiation from the flight inlet
[NASA-CR-172273] N84-15896
Acoustic shocks in a variable area duct containing near sonic flows
[NASA-CR-172274] N84-15897
A review of underwater acoustic systems and methods for locating objects lost at sea
[NASA-TM-85727] N84-15898
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.
Generation of sound in turbulent shear flows N84-15031
Detroit space odessey
[NASA-TM-85487] N84-15164
Arc spray fabrication of metal matrix composite monotape
[NASA-CASE-LEW-13828-1] N84-15203
Evaluation of CO2 and CO dopants in hydrogen to reduce hydrogen permeation in the Stirling engine heater head tube alloy CG-27
[NASA-TM-83535] N84-15246
Tensile and compressive constitutive response of 316 stainless steel at elevated temperatures
[NASA-TM-83506] N84-15249
Performance of computer-designed small-size multistage depressed collectors for a high-perveance traveling wave tube
[NASA-TP-2248] N84-15394
Fluid shielding of high-velocity jet noise
[NASA-TP-2259] N84-15894
Cleveland Space Odyssey
[NASA-TM-85493] N84-16020
Chicago Meets Outer Space program
[NASA-TM-85492] N84-16021
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.
Propulsion apparatus and method using boil-off gas from a cryogenic liquid
[NASA-CASE-MFS-25946-1] N84-15183
Development of an improved protective cover/light block for multilayer insulation
[NASA-TM-82563] N84-15269
Liquid management in low gravity using baffled rotating containers
[NASA-TP-2263] N84-15427
Some properties of a 5-parameter bivariate probability distribution
[NASA-TM-82550] N84-15866
The generalized Euler-Mascheroni constants
[NASA-TP-2264] N84-15880
Significant scientific and technical results at Marshal Space Flight Center
[NASA-TM-82562] N84-16075
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. PASADENA OFFICE, CALIF.
Maser cavity servo-tuning system
[NASA-CASE-NPO-15890-1] N84-15536
Discharge cell for optogalvanic spectroscopy having orthogonal relationship between the probe laser and discharge axis
[NASA-CASE-NPO-16271-1] N84-15537
NATIONAL AEROSPACE LAB., AMSTERDAM (NETHERLANDS).
Wind tunnel tests on a model of a semisubmersible platform and comparison of the results with full-scale data
[NLR-MP-82014-U] N84-15113
Computational procedures in transonic aerodynamic design
[NLR-MP-82020-U] N84-15131
Helix and Felix: Loading standards for use in the fatigue evaluation of helicopter rotor components
[NLR-MP-82041-U] N84-15149
Some notes on 3-dimensional turbulent boundary layer data and turbulence modeling
[NLR-MP-82007-U] N84-15513
We need simplicity and speed. Some examples of simple and fast methods for the measurement of deformations of structures
[NLR-MP-82021-U] N84-15616
Material selection and structural design for safety and durability
[NLR-MP-82023-U] N84-15617
Human visual information processing: Basic viewpoints from psychology and human engineering research
[NLR-MP-82032-U] N84-15798
The creation of the NLR benchmark package and the performance of two new CDC comuters with it
[NLR-MP-82015-U] N84-15819
Numerical modeling and fast-solver calculation of approximately normal shocks
[NLR-MP-82026-U] N84-15856
Some new developments in exact integral equation formulations for sub- or transonic potential flow
[NLR-MP-82024-U] N84-15860
A survey of solution techniques for nonlinear finite element equations
[NLR-MP-82027-U] N84-15861
A local-relaxation method for solving convection-diffusion equations
[NLR-MP-82030-U] N84-15862

NATIONAL BUREAU OF STANDARDS, BOULDER, COLO.
A cryocooler for applications requiring low magnetic and mechanical interference N84-15333
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NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C.
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Thermal conductance and torque of thin section four-point contact ball bearings in vacuum [ESA-ESTL-54] N84-15562
Activities report of the European Space Tribology Laboratory (ESTL) [ESA-ESTL-55] N84-15563
NATIONAL ELECTRICAL ENGINEERING RESEARCH INST., PRETORIA (SOUTH AFRICA).
Integrated circuit failure mechanism detected by IMMA N84-15305
NATIONAL INST. FOR METALLURGY, RANDBURG (SOUTH AFRICA).
The descaling of 3Cr12 steel N84-15322
Surface chemistry in the flotation of minerals N84-15323
Spectroscopic studies on surface reactions between minerals and reagents in flotation systems N84-15324
NATIONAL PHYSICAL RESEARCH LAB., PRETORIA (SOUTH AFRICA).
Proceedings of Symposium on Surface Science and its Industrial Implications [ISBN-0-7988-2417-4] N84-15298
A new non-destructive and standardless method for the thickness determination of thin films by XRF measurement N84-15308
Use of scanning electron microscopy in studying surface reactions of metals with hydrogen N84-15318
NAVAL AIR DEVELOPMENT CENTER, WARMINSTER, PA.
Avionics/crew station integration N84-15042
Crew station evaluation in a dynamic flight simulation facility N84-15069
Electrofluidic angular rate sensor for ejection seat thrust vector control [AD-A133233] N84-15137
The effect of superposing ripple loading of maneuver load cycles [AD-A132653] N84-15148
Theoretical predictions for VLF radio propagation [AD-A133168] N84-15364
NAVAL AIR TEST CENTER, PATUXENT RIVER, MD.
The impact of the F/A-18 aircraft digital flight control system and displays on flight testing and safety N84-15091
NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
An investigation of the indirect boundary element method in One- and two-dimensional elastostatics [AD-A133142] N84-15843
NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY, BAY ST. LOUIS, MISS.
An analysis of aircraft data collected in the Alboran Sea during Donde Va?, 6 - 18 October 1982 [AD-A133995] N84-15746
Snow thickness and brightness temperature on multi-year ice [AD-A133940] N84-15747
Expendable bathythermograph (XBT) measurements in the Western Alboran Sea, October 1982 [AD-A133939] N84-15748
The advection of submesoscale thermal features in the Alboran Sea Gyre [AD-A133877] N84-15749
Short-term measurements of surface currents associated with the Alboran Sea during Donde Va? [AD-A133812] N84-15750
NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CALIF.
F-region variability and HF-propagation N84-15658
NAVAL ORDNANCE STATION, INDIAN HEAD, MD.
Vernier Rocket Motor Mk 84 Mod 0 quality evaluation [AD-A133301] N84-15185
NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.
A guideline for the planning and system requirement determination of a computer based educational system [AD-A133529] N84-15829
NAVAL RESEARCH LAB., WASHINGTON, D. C.
Confidence region for the evaluation of HF DF single site location systems [AD-A133208] N84-15140
US Navy program in small cryocoolers N84-15328
Considerations for choosing microwave transistors in high power shipboard search radars [AD-A133279] N84-15367
Aperture efficiency considerations in the convolution synthesis of symmetrical hexagonal arrays [AD-A133367] N84-15369
Performance characteristics of passive coherence estimators [AD-A133209] N84-15396
The relation between power and energy in the shock initiation of detonations. 1: Basic theoretical considerations and the effects of geometry [AD-A133468] N84-15505
On laser air breakdown, threshold power and laser generated channel length [AD-A133211] N84-15538
Dynamics of a high current electron ring in a conventional betatron accelerator [AD-A133291] N84-15945
Beam current limitations due to instabilities in modified and conventional betatrons [AD-A133337] N84-15947
Finite geometry effects on the stability of a charged beam propagating through a relativistic annular electron beam [AD-A133336] N84-15948
Heat-storage materials for IRCM [AD-A133110] N84-15961
Observation of magnetic fields in laser-produced plasma using the Zeeman effect [DE84-002742] N84-15989
Variation of laser absorption with plasma scalelength in long-scalelength plasmas [DE84-002743] N84-15991
Role of pressure in understanding the anomalous superconductivity in europium (molybdenum)6(sulfur)8 and (TMTSF)2FSO3 [DE83-017292] N84-16012
European Scientific Notes. Volume 37, number 9 [AD-A133558] N84-16079
Calculation of cosmic ray induced single event upsets: Program CRUP (Cosmic Ray Upset Program) [AD-A133620] N84-16113
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, BETHESDA, MD.
Rubber-modified epoxy and glass laminates for application to naval ship structures [AD-A133305] N84-15204
Cavitation inception observations on axisymmetric headforms with turbulence stimulators [AD-A133517] N84-15506
Interactive mechanisms of sliding-surface bearings [AD-A133127] N84-15556
The GPRIME approach to finite element modeling N84-15594
Generalizing the TRAPRG and TRAPAX finite elements N84-15596
Finite element analysis of fluid-filled elastic piping systems N84-15600
NAVAL SUBMARINE MEDICAL RESEARCH LAB., GROTON, CONN.
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NAVAL SURFACE WEAPONS CENTER, WHITE OAK, MD.
Adaptive signal detection for the optimal communications receiver [AD-A133498] N84-15374
NAVAL UNDERWATER SYSTEMS CENTER, NEW LONDON, CONN.
Propagating plane harmonic waves through finite length plates of variable thickness using finite element techniques N84-15601
Propagation of flexural and membrane waves with fluid loaded NASTRAN plate and shell elements N84-15602
NAVAL WEAPONS CENTER, CHINA LAKE, CALIF.
Avionics concept evaluation at the force level N84-15038
Navy's advanced aircraft armament system program concept objectives N84-15045
NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER, SAN DIEGO, CALIF.
Tailored testing theory and practice: A basic model, normal ogive submodels, and tailored testing algorithms [AD-A133385] N84-15824
NEW HAMPSHIRE UNIV., DURHAM.
Multiple scattering from a random and inhomogeneous slab N84-15624
NEW JERSEY INST. OF TECH., NEWARK.
Broadband base isolated asymmetrically fed VHF antenna N84-15393
NEW MEXICO STATE UNIV., LAS CRUCES.
Mie code AGAUS 82 [AD-A133489] N84-15964
NEW YORK UNIV., NEW YORK.
Perception of higher derivatives of visual motion [AD-A133908] N84-15773
NIHON UNIV., TOKYO (JAPAN).
An application of gap regenerator/expander precooled by two stage G-M refrigerator N84-15337
NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIV., GREENSBORO.
Refined test methods in evaluating brittle material strengths [AD-A133596] N84-15610
NORTH CAROLINA COLL., DURHAM.
High precision material study at near millimeter wavelengths [AD-A133575] N84-15966
NORTH CAROLINA STATE UNIV., RALEIGH.
North Carolina used-motor-oil re-refining program: Economics and logistics and operating results [DE84-001448] N84-15277
Use of LANDSAT MSS (multispectral scanner) digital data in water quality mapping of the Neuse River estuary, North Carolina [PB83-256750] N84-15645
NORTH CAROLINA UNIV., CHAPEL HILL.
The chemistry of transition metal carbene complexes [AD-A133541] N84-15225
Moment estimators of defect pattern frequencies, allowing for inspection error [AD-A133487] N84-15568
A law of the iterated logarithm for non-parametric regression function estimators [AD-A133260] N84-15847
On jackknifing kernel regression function estimators [AD-A133236] N84-15867
On the maximum likelihood estimate for logistic errors-in-variables regression models [AD-A133253] N84-15868
NORTH GEORGIA COLL., DAHLONEGA.
Interfacing a two-stage image intensifier tube to an echelle spectrograph N84-16035
NORTHROP CORP., HAWTHORNE, CALIF.
Operational readiness and its impact on fighter avionics system design N84-15037
Towards the functional partitioning of highly integrated, fault tolerant avionics signal processors N84-15047
Simulation requirements to support the development of a fault tolerant avionic system N84-15072
Investigation of fatigue crack-growth resistance of aluminum alloys under spectrum loading [AD-A133206] N84-15251
NOTRE DAME UNIV., IND.
Analog fault diagnosis of large-scale electronic circuits [AD-A133491] N84-15400

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Diode laser spectrophotometry for monitoring acetylene on-line in a liquefaction plant [DE84-002117] N84-15548
Computer-Output Microfiche (COM) on the Oak Ridge computer network [DE84-002422] N84-15836
OAK RIDGE NATIONAL LAB., TENN.
Metals and ceramics research: Processing, properties, and applications [ORNL-5943] N84-15187
Effects of pulsed dual-ion irradiation on phase transformations and microstructure in Ti-modified austenitic alloy [DE84-001985] N84-15257
Stirling engines with controlled evaporation of a two-phase two-component working fluid [DE83-017284] N84-15560
Using PAFEC as a preprocessor for COSMIC/NASTRAN N84-15593
Methodology for the objective validation of model performance, with an application to atmospheric transport models [DE83-015693] N84-15693
Robotics-related technology in the nuclear industry [DE83-017131] N84-15799
Sparse Matrix Software Catalog [AD-A133559] N84-15830
Assessment of Fisher and logistic linear quadratic discrimination models [ORNL/CSD-TM-200] N84-15865
Equilibrium studies for low-aspect-ratio torsatrons [DE84-002264] N84-15979
Radial structure of curvature-driven instabilities in hot-electron plasma [DE84-002256] N84-15986
Raman measurements of the mobile cation vibrations in Na, K, Ag and Li (ALPHA)'-alumina [DE83-015697] N84-16005

OAK RIDGE Y-12 PLANT, TENN.
Ion plating in corrosion protection
[DE84-001182] N84-15256
OAKLAND ELECTRIC, INC., BERKELEY, CALIF.
Design and microprocessor-based implementation of digital frequency selective filters for application in terrain roughness identification
[AD-A133459] N84-15826
OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS (FRANCE).
Helicopter noise N84-15027
Experimental methods in compressor noise studies N84-15028
Instrumentation and signal analysis N84-15032
A systematic characterization of the effects of atmospheric electricity on the operational conditions of aircraft N84-15086
OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, TOULOUSE (FRANCE).
Effects of unsteadiness on turbulent boundary layers N84-15457
Three-dimensional wake of a swept wing N84-15458
OFFICE OF NAVAL RESEARCH, LONDON (ENGLAND).
Applied psychology in Europe: An ONR perspective
[AD-A133093] N84-15797
Robot manipulator control
[AD-A129365] N84-15800
OHIO STATE UNIV., COLUMBUS.
Effect of UV illumination on the sublimation of basal surfaces of zinc oxide
[AD-A133363] N84-15222
Radiation patterns of an antenna mounted on the mid-section of an ellipsoid
[AD-A133203] N84-15365
Adaptive arrays for multiple simultaneous desired signals
[AD-A133486] N84-15373
The calculated performance of some radar and transmissometer systems in rain and fog at 35, 94, 140 and 240 GHz, volume 1
[AD-A133587] N84-15380
Coherent electromagnetic wave propagation and scattering in random media
[AD-A133601] N84-15381
Optical flow and texture variables useful in simulating self motion (2)
[AD-A133597] N84-15779
OKLAHOMA UNIV., NORMAN.
Optimization of waverider configurations generated from non-axisymmetric flows past a nearly circular cone N84-15108
Relationships between thunderstorm mesoscale circulation and tornadogenesis N84-15727
OLD DOMINION UNIV., NORFOLK, VA.
An investigation of accelerating mechanisms in a plasma focus relevant to interrupting switches
[AD-A133462] N84-15983
OPERATIONAL RESEARCH AND ANALYSIS ESTABLISHMENT, OTTAWA (ONTARIO).
Computer aided construction of ground attack mission profiles over European terrain N84-15060
OPTRA, INC., EVERETT, MASS.
Rapid identification of micro-organisms
[AD-A132831] N84-15759
ORANGE FREE STATE UNIV., BLOEMFONTEIN (SOUTH AFRICA).
A formula for the sputtering yield of polycrystalline materials N84-15313
Oxygen adsorption and initial oxidation of single crystal first row transition metal and alloy surfaces N84-15316
Surface segration and diffusion investigations by means of AES N84-15319
OREGON HEALTH SCIENCES UNIV., PORTLAND.
Countercurrent distribution of biological cells
[NASA-CR-170958] N84-15755
OREGON STATE SYSTEM OF HIGHER EDUCATION, MONMOUTH.
The structure of turbulent entraining flow in an annulus with a rotating screen N84-15416
OREGON STATE UNIV., CORVALLIS.
Passive source localization from spatially correlated angle-of-arrival data
[AD-A133141] N84-15362
OREGON UNIV., EUGENE.
Pacific Northwest solar radiation data
[DE84-002335] N84-15738
OVERSEAS RELATIONS BRANCH TRANSLATION SERVICE, LONDON (ENGLAND).
A melt for the electrolytic application of titanium plating
[BLL-OA-TRANS-3111-(6L96.3)] N84-15241

P

PACIFIC NORTHWEST LAB., RICHLAND, WASH.
Scaling wind characteristics for designing small and large wind turbines
[DE83-014501] N84-15728
PARIS VI UNIV. (FRANCE).
Least squares and domain decomposition methods applied to the numerical solution of nonlinear problems in fluid dynamics N84-15468
PATTERN ANALYSIS AND RECOGNITION CORP., NEW HARTFORD, N.Y.
ECM (Electronic Counter Measure) signal discrimination and identification techniques
[AD-A133427] N84-15372
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Comparison of steady state transitions in truncated spectral and finite difference models of two-dimensional shallow convection N84-15417
Three-dimensional turbulent boundary layers N84-15459
Three-dimensional turbulent boundary layers in turbomachines N84-15460
Analysis of plates by the initial-value method N84-15622
Combined use of remote sensing and seismic observations to infer geologically recent crustal deformation, active faulting, and stress fields
[E84-10057] N84-15628
Synthesis of regional crust and upper-mantle structure from seismic and gravity data
[E84-10061] N84-15631
A diagnostic case study of the effects of deep extratropical convection on the large-scale temperature and moisture structure N84-15695
Ocean temperature changes induced by tropical cyclones N84-15722
Some effects of surface heating and topography on the regional severe storm environment N84-15723
Utilization of satellite data in mesoscale models of severe weather
[NASA-CR-175122] N84-15730
Acoustic diffraction by an impedance-covered edge
[AD-A133268] N84-15904
PENNSYLVANIA UNIV., PHILADELPHIA.
Scintillators and waveshifters for fast scintillator-WSB calorimetry N84-15929
Calorimetry at L = 10/sup 33 N84-15931
Electromagnetic, gravitational, and neutrino waves in flat and curved spacetime N84-16111
PERKIN-ELMER AND CO. G.M.B.H., MUNICH (WEST GERMANY).
Experience in surface analysis applied to technical material problems N84-15303
Grain boundary segregation and cavity formation in creep embrittled Cr-Mo steels N84-15320
PHILIPS LABS., BRIARCLIFF MANOR, NEW YORK.
A 10 deg K triple-expansion Stirling-cycle cryocooler N84-15336
Life test performance of a Philips rhombic-drive refrigerator with bellows seals N84-15341
A magnetically suspended linearly driven cryogenic refrigerator N84-15345
POITIERS UNIV. (FRANCE).
Analytical solutions for the flow field induced by a spherical flame expanding at constant velocity N84-15445
PORT ELIZABETH UNIV., CAPE PROVINCE (SOUTH AFRICA).
Surface photoluminescence and it application N84-15304
PRETORIA UNIV. (SOUTH AFRICA).
Depth resolution due to instrumental factors in sputter-assisted depth profiling N84-15315
Evaluation of the pitting corrosion resistance of a Fe-12% Cr alloy N84-15321
The heterogeneous nucleation of ice I N84-15325
Structural properties of epitaxial single layer metals on (110) B.C.C. metal substrates N84-15326
PRINCETON UNIV., N. J.
A study of helicopter rotor aerodynamics in ground-effect at low speeds N84-15106
PRINS MAURITS LAB. TNO, RIJSWIJK (NETHERLANDS).
Estimate of blast wave properties N84-15443
Vapor cloud explosion experiments N84-15444
Interaction of gas explosions with buildings N84-15447
PRITCHARD (C. LEWIS), CROSSVILLE, TENN.
Gasogen for automobile use
[DE84-000712] N84-15291
PURDUE UNIV., LAFAYETTE, IND.
Application of interactive computer graphics in finite element analysis N84-15575
Seismic properties of the crust and uppermost mantle of North America
[NASA-CR-175134] N84-15708
On Bayes and empirical bayes rules for selecting good populations
[AD-A133336] N84-15869
An estimation problem relating to subset selection for normal populations
[AD-A133387] N84-15870
The 2-stage selection procedures based on tests
[AD-A133405] N84-15871
A numerical investigation of the multiple vortex phenomenon: Vortex number and structure as a function of swirl ratio N84-16049
A new treatment of incomplete information and retrieval in relational data bases N84-16069

R

RACAL-DECCA LTD., CHESSINGTON (ENGLAND).
10 cm radar ground clutter measurements taken from a coastal steamer radar on passage from Bergen to North Cape in May 1982 N84-15667
RADIATION MONITORING DEVICES, INC., WATERTOWN, MASS.
Replicated CdTe substrates
[AD-A133114] N84-15994
RAND CORP., SANTA MONICA, CALIF.
Perspectives on oversight management of software development projects
[AD-A133404] N84-16064
RANGE COMMANDERS COUNCIL, WHITE SANDS MISSILE RANGE, N. MEX.
IRIG standard for distributing interrange vector acquisition data
[AD-A133617] N84-15170
Range reference atmosphere 0-30 km altitude, Eglin AFB, Florida
[AD-A133506] N84-15734
Taquac, Guam Island. Range reference atmosphere 0-30 km altitude
[AD-A133618] N84-15736
READING UNIV. (ENGLAND).
Equations of fluid flow, finite difference approximations and basic mathematical properties of each N84-15430
RENSSELAER POLYTECHNIC INST., TROY, N. Y.
Biaxial fatigue of graphite/epoxy + or - 45 sub s tubes N84-15210
Finite element analysis of moisture and external loading effects in composites N84-15211
Heat capacity and thermodynamic properties of linear macromolecules N84-15263
Digital communication in the presence of impulsive noise N84-15392
Direct multivariable model reference adaptive control with applications to large structural systems N84-15840
RESEARCH INST. OF NATIONAL DEFENCE, LINKOEPING (SWEDEN).
A computer model for an imaging coherent laser radar
[FOA-C-30341-E] N84-15388
Microwave tubes: Literature survey number 4, comprising the year 1982
[FOA-C-30331-E] N84-15407
Landsat 4 TM-data: Examples of resolution capacity
[FOA-C-30329-E1] N84-15644
RESEARCH INST. OF NATIONAL DEFENCE, STOCKHOLM (SWEDEN).
Resin development in advanced composites
[FOA-C-20509-F9] N84-15208
RESEARCH INST. OF NATIONAL DEFENCE, UMEA (SWEDEN).
Immobilization of biomolecules on semiconductor surfaces
[FOA-C-40178-C2(B2,A3)] N84-15408
Dose conversion factors for inhaled radionuclides
[FOA-C-40184-A3] N84-15786
ROCHESTER UNIV., N. Y.
Application of the density matrix multipole expansion to stark quantum beats from beam-foil-excited hydrogen atoms
[AD-A133603] N84-15193
An experimental investigation of the boundary layer structures in a partially-filled horizontal and rapidly-rotating cylinder N84-15414
Instability and transition in the boundary layer N84-15516
Development of an XUV amplifier N84-15532
Exposure chamber for studies of pollutant gases and aerosols in human subjects: Design considerations
[DE84-001135] N84-15785
Emission of short-wavelength photons from ion-surface charge exchange
[AD-A133183] N84-15942
Observations of the unidentified 3.3 microns emission feature in compact HII regions N84-16089

ROCKETDYNE, CANOGA PARK, CALIF.
Atomization and mixing study
[NASA-CR-170943] N84-15428
ROCKWELL INTERNATIONAL CORP., CANOGA PARK, CALIF.
Atomization and mixing study
[NASA-CR-170943] N84-15284
ROCKWELL INTERNATIONAL CORP., GOLDEN, COLO.
Elastomeric impression materials and cleaning systems for residue removal
[RFP-3442] N84-15296
Further abbreviation of the machining schedule for producing surface-damage-free beryllium
[DOE/TIC-4500-REV-69] N84-15297
ROCKWELL INTERNATIONAL CORP., THOUSAND OAKS, CALIF.
AlGaAsSb vapor phase epitaxy and laser program
[AD-A133123] N84-15995
ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.
Phase-only nulling at symmetric pattern locations
[AD-A133128] N84-15361
ROME AIR DEVELOPMENT CENTER, HANSCOM AFB, MASS.
HF over-the-horizon mapping of the Greenland icecap N84-15654
ROME UNIV. (ITALY).
Linear prediction methods
[FUB-52-1982] N84-15858
ROYAL AIRCRAFT ESTABLISHMENT, BEDFORD (ENGLAND).
Worldwide experience of wind shear during 1981-1982 N84-15087
An introduction to numerical methods suitable for the Euler equations N84-15431
ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH (ENGLAND).
A future system design technique based on functional decomposition, supported by quantifiable design aims, and guidelines for minimum maintenance costs N84-15039
DEF STAN 00-18: A family of compatible digital interface standards N84-15049
Increased aircraft survivability using direct voice input N84-15100
Relationship between the glass transition temperature and the chemical structure of polymers
[RAE-LIB-TRANS-2098] N84-15265
ROYAL NORWEGIAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, KJELLER.
Multifrequency scattering for target characterization and identification: A summary of recent results N84-15663
The Norwegian Seismic Array (NORSAR). Phase 3
[AD-A134038] N84-15713
RPK CORP., ATHENS, GA.
A new method for generating and maintaining rigid formats in NASTRAN N84-15605
RUHR UNIV., BOCHUM (WEST GERMANY).
Unified operator description, nonlinear buckling and post-buckling analysis of thin elastic shells
[RUB-IFM-MITT-34] N84-15582
RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N. J.
Crazing and fatigue behaviour of one and two phase polymers N84-15282

S

SAINT LOUIS UNIV., MO.
Experiments on factors that influence muscular function in man
[AD-A133928] N84-15771
SANDIA LABS., ALBUQUERQUE, N. MEX.
High-speed, low-altitude payload delivery using a single large ribbon parachute
[DE84-002731] N84-15128
New, high performance rotating parachute
[DE84-002382] N84-15129
Pit initiation resistance of ferritic stainless steels in chloride environments from 800 to 2600C
[DE84-000355] N84-15258
Volume recovery in glasses: A free-volume diffusion process
[DE83-013771] N84-15280
Time delay estimation using the adaptive delay element
[DE84-002042] N84-15403
Second-order adaptive infinite impulse response filter
[DE84-001768] N84-15406
General method for fatigue analysis of vertical axis wind turbine blades
[DE84-002654] N84-15613
Microcrack damage model of brittle rock
[DE84-002088] N84-15717
InAsSb strained-layer superlattices for long wavelength detector applications
[DE84-001055] N84-16004
An In0 2Ga0 8As/GaAs, modulation-doped, strained-layer superlattice field-effect transistor
[DE84-000136] N84-16006
Ion-beam analysis and ion implantation in the study of diffusion
[DE84-000354] N84-16008
SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Duration of memory loss due to electron beam exposure
[AD-A132941] N84-15760
Organizational-climate dimensions: A conceptual and judgmental analysis
[AD-A132868] N84-16068
SCIENCE APPLICATIONS, INC., PRINCETON, N.J.
Fully-coupled analysis of jet mixing problems. Part 1. Shock-capturing model, SCIPVIS
[NASA-CR-3761] N84-15425
SCIENCE APPLICATIONS, INC., SAN DIEGO, CALIF.
Satellite measurements of marine aerosols N84-15671
SCIENCE APPLICATIONS, INC., SCHAUMBURG, ILL.
Joint Atomic Information Exchange Group information management project. Briefing outlining functions and specifications of JAIEG automated information management system
[DE84-001800] N84-16082
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[DE84-001798] N84-16083
SCIENCE RESEARCH COUNCIL, CHILTON (ENGLAND).
Ionospheric factors affecting the performance of HF sky-wave sea-state radars N84-15656
SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.
Passive remote sensing of ocean optical propagation parameters N84-15673
Program in marine physics applied to Navy undersea missions
[AD-A133119] N84-15753
Marine environmental acoustics
[AD-A133245] N84-15902
SEGNALAMENTO MARITTIMO ED AEREO S.P.A., FLORENCE (ITALY).
Statistical data on anomalous propagation in the Tyrrhenian Sea using an X-band link N84-15668
SELENIA S.P.A., ROME (ITALY).
Rivista Tecnica Selenia, volume 8, number 2, 1982 N84-15882
Advanced techniques of laser telemetry N84-15883
An approach to logistic problems by the L-transform method N84-15884
Optimum and sub-optimum processors for multistatic radar systems N84-15885
A digital ferrite phase-shifter for high power S-band operation N84-15886
Rivista Tecnica Selenia, volume 8, number 3, 1983 N84-15887
Local area networks: Impact on shipboard applications N84-15888
A radar signal processor implemented with surface acoustic waves devices N84-15889
The maximum entropy method and its application to clutter cancellation N84-15890
The meteorological data distribution mission on board SIRIO satellite N84-15891
SHE CORP., SAN DIEGO, CALIF.
Regeneration experiments below 10K in a regenerative-cycle cryocooler N84-15332
4.0 K cryocooler project
[DE84-000332] N84-15358
SIMON FRASER UNIV., BURNABY (BRITISH COLUMBIA).
Regeneration efficiency, shuttle heat loss and thermal conductivity in epoxy-composite annuair gap regenerators from 4K to 80K N84-15335
SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
Data analysis and theoretical studies for atmospheric Explorer C, D and E
[NASA-CR-175121] N84-15711
SOCIETE BELGE POUR L'INDUSTRIE NUCLEAIRE, BRUSSELS (BELGIUM).
Single phase sodium flow in complex and deformed generators N84-15489
Thermohydraulic applications of liquid metals in the non-nuclear field N84-15501
SONEX RESEARCH, INC., ANNAPOLIS, MD.
NAHBE (Naval Academy Heat Balanced Engine) m151 retrofit evaluation
[AD-A133475] N84-15559
SOUTH AFRICAN COPPER DEVELOPMENT ASSOCIATION (PTY) LTD., MARSHALLTOWN.
Surface coating systems for copper and copper alloys N84-15311
SOUTHAMPTON UNIV. (ENGLAND).
A review of source location/assessment techniques N84-15029
Shock associated noise N84-15030
SOUTHERN METHODIST UNIV., DALLAS, TEX.
Site-dependent inelastic response spectra N84-15620
Theoretical and empirical terrestrial heat flow studies N84-15696
SPERRY GYROSCOPE CO., GREAT NECK, N. Y.
BANDIT in NASTRAN N84-15591
SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Image understanding research and its application to cartography and computer-based analysis of aerial imagery
[AD-A133495] N84-15642
Propagation effects in satellite-borne synthetic aperture radars N84-15650
In situ characterization of seawater using a computerized suite of optical instruments N84-15675
Spatiotemporal characteristics of visual localization
[AD-A133952] N84-15770
Research topics in statistical database management
[DE84-002581] N84-16080
STANFORD JOINT INST. FOR SURFACE AND MICROSTRUCTURAL RESEARCH, MOFFETT FIELD, CALIF.
Fabrication and properties of multilayer structures
[NASA-CR-174506] N84-15997
STANFORD LINEAR ACCELERATOR CENTER, CALIF.
A 650 mm long liquid hydrogen target for use in a high intensity electron beam
[DE84-002552] N84-15955
Problems at the interface between perturbative and nonperturbative quantum chromodynamics
[DE84-002375] N84-16018
STANFORD UNIV., CALIF.
An experimental study of airfoil-spoiler aerodynamics N84-15133
Aerodynamics, aeroelasticity, and stability of hang gliders N84-15134
Three-dimensional, periodic halo orbits in the restricted three-body problem N84-15167
High resolution ultraviolet laser spectroscopy of mercury and helium N84-15214
The CARS spectroscopy in a supersonic jet N84-15216
The satellite applications of amplitude companded single sideband modulation N84-15391
Experimental mixed convection heat transfer from a large vertical surface in a horizontal flow N84-15412
Numerical simulation of separated flows N84-15413
An experimental investigation of the structure of a turbulent reattaching flow behind a backward-facing step N84-15415
Improved turbulence models based on large eddy simulation of hon.ogeneous, incompressible turbulent flows N84-15514
All-fiber gyroscope with optical-Kerr-effect compensation N84-15518
Subpicosecond-relaxation studies using tunable-laser-induced-grating techniques N84-15531
Coherent effects in laser spectroscopy N84-15533
Aeroelastic analysis of a Darrieus type wind turbine blade with tropoekien geometry N84-15623
Wave propagation in porous rock and models for crustal structure N84-15698
Dip-moveout by Fourier transform N84-15699
Development and perturbation analysis of model stochastic equations for global circulation N84-15743
On the fitting of Pearson curves to sums of independent random variables
[AD-A133153] N84-15844
Control of impurities in the epitaxial growth of high quality GaAs
[AD-A133187] N84-15996
Fabrication and properties of multilayer structures
[NASA-CR-174506] N84-15997
STATE UNIV. OF NEW YORK, ALBANY.
Thematic mapper radiomtric variability on ostensibly uniform agricultural scenes
[E84-10035] N84-15626
Clear atmospheric effects on insolation illustrated by broad-band radiometer measurements N84-15701
STATE UNIV. OF NEW YORK, BUFFALO.
Polymer coated electrodes in ambient temperature molten salts
[AD-A133202] N84-15220
STEVENS INST. OF TECH., HOBOKEN, N. J.
An NMR study of solid hydrogen using packer solid echoes and rotating reference frame relaxation N84-15992

STRUCTURAL SEMANTICS, PALO ALTO, CALIF.
Linguistic methodology for the analysis of aviation accidents
[NASA-CR-3741] N84-15135
SUMITOMO HEAVY INDUSTRIES LTD., HIRATSUKA (JAPAN).
A small and light weight heat exchanger for on-board helium refrigerator N84-15339
SUZUKI SHOKAN CO. LTD. (JAPAN).
Compact Claude cycle refrigerator for laboratory use N84-15338
SVERDRUP TECHNOLOGY, INC., ARNOLD AIR FORCE STATION, TENN.
Dynamic certification of a thrust-measuring system for large solid rocket motors N84-15603
SYRACUSE UNIV., N. Y.
Prospects for Cerenkov ring imaging at hadron colliders N84-15934
SYSTEMS AND APPLIED SCIENCES CORP., HYATTSVILLE, MD.
FGGE/SBUV tape specification and shipping letter description
[NASA-CR-170482] N84-16071
FGGE/ERBM tape specification and shipping letter description
[NASA-CR-170547] N84-16072
FGGE/ERBZ tape specification and shipping letter description
[NASA-CR-170548] N84-16073
FGGE/SMMR-30 tape specification and shipping letter description
[NASA-CR-170550] N84-16074
SYSTEMS CONTROL, INC., PALO ALTO, CALIF.
Assessment of load-frequency-control impacts caused by small wind turbines
[DE82-011513] N84-15677
SYSTEMS SCIENCE AND SOFTWARE, LA JOLLA, CALIF.
Surface wave path corrections, deterministic discrimination and body wave attenuation
[AD-A133574] N84-15714

T

TECHNION - ISRAEL INST. OF TECH., HAIFA.
Coherently pumped two-frequency laser-type devices
[AD-A133439] N84-15545
Fatigue crack propagation in Al-alloy lugs under constant amplitude and maneuver spectrum loading
[TAE-497] N84-15585
Optimal reconstructions and n-widths
[AD-A133576] N84-15853
Improved dynamic models for air combat analysis
[TAE-483] N84-15876
TECHNISCHE HOCHSCHULE, AACHEN (WEST GERMANY).
Finite-difference approximations of the Navier-Stokes equations for incompressible flows N84-15434
TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS).
Reflection and transmission of electromagnetic waves at a rough interface between two different media
[PB83-217588] N84-15389
Diffraction of a plane electromagnetic wave by an elliptic cylinder: The multi-origin technique
[PB83-166769] N84-15390
Computation of the temperature distribution due to eddy-currents in the wall of a power transformer
[PB83-217273] N84-15410
Brief note of the stress intensity factor of elliptical cracks
[PB83-216911] N84-15618
Introduction to the FORTRAN 14 programs Duvorol and Contact for the solution of 3 D elastostatic half-space contact problems with and without friction
[PB83-147421] N84-15833
Constrained function minimization. Comparison of the augmented Lagrangian and sequentially increasing penalty method
[PB83-217265] N84-15863
Least-square iterative techniques for solving integral equations
[PB83-166751] N84-15864
TECHNISCHE HOGESCHOOL TWENTE, ENSCHEDE (NETHERLANDS).
Edge- and contour detection for correction of low-pass filtered images
[PB83-217489] N84-15969
TECHNISCHE UNIV., BERLIN (WEST GERMANY).
Some aspects of two-dimensional compressible turbulent boundary layers N84-15456
TECHNISCHE UNIV., BRUNSWICK (WEST GERMANY).
Influence of windshear on flight safety N84-15088
TECHNISCHE UNIV., VIENNA (AUSTRIA).
Surface analysis by particle beams N84-15301
TECHNOLOGY AND MANAGEMENT SYSTEMS, INC., BURLINGTON, MASS.
Unconfined vapor cloud explosions: A review of recent theories and experiments N84-15439
TELEDYNE BROWN ENGINEERING, HUNTSVILLE, ALA.
Payload missions integration
[NASA-CR-170949] N84-15171
TENNESSEE TECHNOLOGICAL UNIV., COOKEVILLE.
Synthesis of N-substituted silaneamines: Monomeric precursors of silicon carbide-nitride fibers N84-16033
Stiffness properties for dynamic modeling of composite graphite-epoxy cylindrical orthotropic shells N84-16054
TENNESSEE UNIV., KNOXVILLE.
Preionization and start-up in the ISX-B Tokamak using electron cyclotron heating at 28 GHz
[DE84-002261] N84-15984
Analytical and numerical solution for a solidifying liquid alloy slab N84-16025
TENNESSEE UNIV., TULLAHOMA.
Acoustic shocks in a variable area duct containing near sonic flows
[NASA-CR-172274] N84-15897
TENNESSEE UNIV. SPACE INST., TULLAHOMA.
The development of a digital processing system for accurate range determinations N84-16046
TETRA TECH, INC., PASADENA, CALIF.
Techniques for measuring radiance in the air and sea N84-15672
TEXAS A&M UNIV., COLLEGE STATION.
Luminescence probe studies of nafion polyelectrolytes
[AD-A133519] N84-15224
Development of visible/infrared/microwave agriculture classification and biomass estimation algorithms, volume 2
[E84-10059] N84-15629
Investigation of the arc cloud complex N84-16029
TEXAS TECHNOLOGICAL UNIV., LUBBOCK.
Nonlinear transformat
[NASA-CR-166506] N84-15877
TEXAS UNIV., AUSTIN.
Multishaker modal testing
[NASA-CR-170952] N84-15521
Digital multishaker modal testing
[NASA-CR-170951] N84-15522
Elimination of stochasticity in stellarators
[DE84-001560] N84-15985
Nonlinear interaction of toroidicity induced drift modes
[DE84-001562] N84-15987
Drift waves in rotating plasmas
[DE84-000391] N84-15988
Sustained self-reversal in the reversed field pinch
[DE84-001559] N84-15990
TEXTRON BELL AEROSPACE CO., BUFFALO, N. Y.
NASTRAN documentation for flutter analysis of advanced turbopropellers
[NASA-CR-167927] N84-15153
Bladed-shrouded-disc aeroelastic analyses: Computer program updates in NASTRAN level 17.7
[NASA-CR-165428] N84-15154
TOHOKU UNIV., SENDAI (JAPAN).
Japanese activities in refrigeration technology N84-15330
TRW ENERGY SYSTEMS, REDONDO BEACH, CALIF.
Photodetachment neutralizer development. Laser-resonator study. Volume 1: Summary
[DE84-001682] N84-15547
TRW SPACE TECHNOLOGY LABS., REDONDO BEACH, CALIF.
ACOSS Fourteen (Active Control of Space Structures)
[AD-A133411] N84-15181
The nature of microwave backscattering from water waves N84-15665
Plasma wave experiment for the ISEE-3 mission
[NASA-CR-175132] N84-15972
TUFTS UNIV., BOSTON, MASS.
Stress fractures: The remodelling response to excessive repetitive loading
[AD-A130861] N84-15765
TUFTS UNIV., MEDFORD, MASS.
Very Large Array observations of solar active regions. 4: Structure and evolution of radio bursts from 20 cm loops
[AD-A133907] N84-16109
The circularly polarized sun at 12.6 cm wavelength
[AD-A133668] N84-16110
TUSKEGEE INST., ALA.
Ultrahigh molecular weight aromatic siloxane polymers N84-16042

U

UNITED KINGDOM ATOMIC ENERGY AUTHORITY, CULHAM (ENGLAND).
Thermohydraulics of LMFBR core catchers N84-15500
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, RISLEY (ENGLAND).
Embrittlement of steels due to galvanizing or coating with zinc paint: An investigation of embrittlement in welding or heating operations
[AERE-TR-4774] N84-15244
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, WINDSCALE (ENGLAND).
Corrosion of TIG welded austenitic stainless steels
[BLL-WINDSCALE-TR-959-(9091.F)] N84-15235
UNITED TECHNOLOGIES CORP., SUNNYVALE, CALIF.
Propellant nonlinear constitutive theory extension: Preliminary results
[AD-A133364] N84-15287
UNITED TECHNOLOGIES RESEARCH CENTER, EAST HARTFORD, CONN.
Heat transfer retardation at elevated temperatures. Phase 1: Analysis of heat transfer retardation configurations and materials
[AD-A133509] N84-16017
UNIVERSITY OF EASTERN KENTUCKY, RICHMOND.
Studies of neutron and proton nuclear activation in low-Earth orbit 2 N84-16041
UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
Eddy detection within turbulent shear flows N84-15453
The bursting phenomenon in bounded shear flows N84-15454
Large scale motion in turbulent boundary layers N84-15455
A representation for shape based on peaks and ridges in the difference of low-pass transform
[AD-A133299] N84-15849
Performance appraisal revisited
[AD-A132841] N84-16059
Incentives for controlling the performance of high technology and professional employees
[AD-A134074] N84-16061
Organizational outcomes of creativity
[AD-A132825] N84-16066
The design of effective reward systems
[AD-A132859] N84-16067
UNIVERSITY OF SOUTHERN CALIFORNIA, REDONDO BEACH.
A performance-based technique for assessing equipment maintainability
[AD-A133518] N84-15809
UNIVERSITY OF SOUTHERN ILLINOIS, CARBONDALE.
An estimation problem relating to subset selection for normal populations
[AD-A133387] N84-15870
UNIVERSITY OF THE PACIFIC, FOREST GROVE, OREG.
Evaluation of factors producing visual evoked response variability
[AD-A133917] N84-15772
UNIVERSITY OF WESTERN MICHIGAN, KALAMAZOO.
Simultaneous electron capture and excitation in ion-atom collisions
[DE83-005799] N84-15907
UNIVERSITY SPACE RESEARCH ASSOCIATION, HUNTSVILLE, ALA.
Evaluation of 2 1-D cloud models for the analysis of VAS soundings
[NASA-CR-3771] N84-15729

V

VARIAN ASSOCIATES, PALO ALTO, CALIF.
Organometallic epitaxy for GaAs/AlGaAs microwave transistors and integrated circuits
[AD-A133569] N84-16001
VIRGINIA MASON RESEARCH CENTER, SEATTLE, WASH.
Interaction of anti-G measures and chest wall mechanics in determining gas exchange
[AD-A133740] N84-15775
VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Computational and experimental study of trailing vortices N84-15103
Fatigue damage-strength relationships in composite laminates. Volume 1
[AD-A133485] N84-15206
Nonlinear viscoelastic characterization of structural adhesives
[NASA-CR-172279] N84-15268
The influence of surface roughness on the transfer and wear of polymers
[AD-A133527] N84-15275
Spatial reasoning to determine stream network from LANDSAT imagery
[E84-10063] N84-15632

Two stochastic modeling problems in communications and navigation
[AD-A133458] N84-15873

VLIEGBASIS VOLKEL (NETHERLANDS).
Physiological and psychological aspects of the piloting of modern high-performance combat aircraft N84-15099

VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE (BELGIUM).
Aeroacoustics: Ten Years of Research
[VKI-LS-1983-05] N84-15025
A model of the trailing edge separation on an airfoil
[AD-A126703] N84-15125
Introduction to computational fluid dynamics
[VKI-LS-1983-01] N84-15429
A finite difference technique for laminar and turbulent compressible boundary layers N84-15433
Unconfined gas explosions
[VKI-LS-1983-02] N84-15438
Characterization of the pressure wave originating in the explosion of a gas cloud N84-15446
Turbulent shear flows
[VKI-LS-1983-03] N84-15448
Computational Fluid Dynamics, volume 1
[VKI-LS-1983-04-VOL-1] N84-15461
Computational Fluid Dynamics, volume 2
[VKI-LS-1983-04-VOL-2] N84-15467
Computation of turbulent gas-particle suspension flows in channels N84-15470
Aerothermodynamics of Low Pressure Steam Turbines and Condensers, volume 1
[VKI-LS-1983-06-VOL-1] N84-15472
Aerothermodynamics of Low Pressure Steam Turbines and Condensers, Volume 2
[VKI-LS-1983-06-VOL-2] N84-15482
Two dimensional condensing flow in transonic turbine cascades N84-15484
Thermohydraulics of liquid metals, volume 1
[VKI-LS-1983-07-VOL-1] N84-15487
Turbulence modeling in liquid metal free convection N84-15490
Thermohydraulics of liquid metals, volume 2
[VKI-LS-1983-07-VOL-2] N84-15494
The effects of acoustic excitation on the mixing of two parallel laminar streams of fluid
[AD-A126788] N84-15502
The salt-gradient solar pond
[AD-A126702] N84-15683

VOUGHT CORP. ADVANCED TECHNOLOGY CENTER, INC., DALLAS, TEX.
The effect of environment on the mechanical behavior of AS/3501-6 graphite/epoxy material
[AD-A133331] N84-15205

VRIJE UNIVERSITEIT, BRUSSELS (BELGIUM).
Finite element methods for potential flows N84-15437

W

WASHINGTON UNIV., SEATTLE.
XCP measurements off California in October 1982: Cruise report and preliminary results
[AD-A133051] N84-15754
Effects of long-term low-level radiofrequency radiation exposure on rats. Volume 1: Design, facilities, and procedures
[AD-A134079] N84-15756
Average vibrational energy transfer during a single collision of excited molecules with heat bath molecules
[AD-A133391] N84-15949
Giant dipole resonances built on excited states
[DE84-001549] N84-15954

WESTINGHOUSE ELECTRIC CORP., BALTIMORE, MD.
Tactical requirements impact on avionics/weapon system design N84-15036

WESTINGHOUSE ELECTRIC CORP., PHILADELPHIA, PA.
Applications of through-flow theory N84-15477
Trends in steam turbine design, testing and manufacturing N84-15478

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
Recent advances in variable speed electrical generator systems for large wind turbines
[DE84-001833] N84-15404
Techniques for sensor-based diagnosis
[AD-A133297] N84-15814

WESTINGHOUSE HANFORD CO., RICHLAND, WASH.
Feasibility of thermal NDE methods for Naval thermal spray coatings
[DE84-001463] N84-15569

WISCONSIN UNIV., MADISON.
Laser optical pumping of sodium and lithium atom beams N84-15534
Investigation of static and dynamic fracture of orthotropic media by photomechanics N84-15625
Investigation of antarctic crust and upper mantle using MAGSAT and other geophysical data
[E84-10055] N84-15627
A comparison of NMC models (1977) on precipitation forecasts for east coast cyclogenesis N84-15720
Possible tidal modulation of the Indian monsoon onset N84-15721
Bone blood flow measured by (41)Ar clearance formed by (44)Ca(n,(-)) (41)Ar
[DE83-017600] N84-15761
Experimental designs for quantal response models
[AD-A133416] N84-15851
Diffraction techniques
[AD-A133254] N84-15944
State-to-state unimolecular reaction dynamics
[DE84-003009] N84-15952

WITWATERSRAND UNIV., JOHANNESBURG (SOUTH AFRICA).
The measurement of surface texture and its correlation with function N84-15299
Surface and near-surface analysis of diamond by RBS N84-15302

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.
The long term upper ocean study (LOTUS). Cruise summary and hydrographic data report, ENDEAVOR 97, April 1983
[AD-A134005] N84-15745
The numerical synthesis and inversion of acoustic fields using the Hankel transform with application to the estimation of the plane wave reflection coefficient of the ocean bottom
[AD-A133156] N84-15901

WORLD METEOROLOGICAL ORGANIZATION, GENEVA (SWITZERLAND).
Tropical cyclone operational plan for the Southwest Indian Ocean
[WMO-618] N84-15741

WYOMING UNIV., LARAMIE.
Infrared measurements of AFGL (Air Force Geophysics Laboratory) sources
[AD-A133553] N84-16098

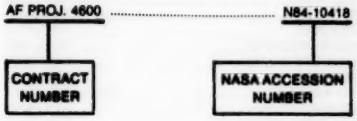
Y

YALE UNIV., NEW HAVEN, CONN.
Classifying bugs is a tricky business
[AD-A133264] N84-15813
PROUST: Knowledge-based program understanding
[AD-A133447] N84-15825
A learning approach to routing in data communication networks
[REPT-8212] N84-15834
An investigation of the use of iterative linear equation solvers in codes for large stiff systems of ODE's
[AD-A133189] N84-15845

Z

ZIMBABWE UNIV., SALISBURY.
The use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition N84-15307

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

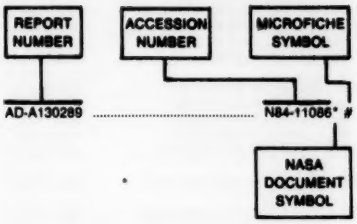
AF PROJ. C654 ..... N84-15181
AF PROJ. ILIR N84-15527
AF PROJ. 1L1-62622-A-552 ..... N84-15539
AF PROJ. 492B N84-15368
AF PROJ. 1121 ..... N84-15639
AF PROJ. 2029 ..... N84-15366
AF PROJ. 2104 ..... N84-15146
AF PROJ. 2155 ..... N84-15372
AF PROJ. 2301 ..... N84-15125
N84-15544
N84-15683
N84-15794
N84-15943
N84-15946
N84-15983
AF PROJ. 2304 ..... N84-15835
N84-15842
N84-15845
N84-15846
N84-15847
N84-15867
N84-15868
AF PROJ. 2305 ..... N84-15361
AF PROJ. 2306 ..... N84-15250
N84-15253
N84-15999
AF PROJ. 2307 ..... N84-15206
N84-15207
N84-15287
AF PROJ. 2310 ..... N84-15639
N84-15735
AF PROJ. 2311 ..... N84-16109
N84-16110
AF PROJ. 2312 ..... N84-15771
N84-15775
N84-15776
AF PROJ. 2313 ..... N84-15770
N84-15772
N84-15773
N84-15779
AF PROJ. 2402 ..... N84-15733
AF PROJ. 2403 ..... N84-15160
AF PROJ. 2419 ..... N84-15274
AF PROJ. 2423 ..... N84-15994
AF PROJ. 3020 ..... N84-15998
AF PROJ. 3145 ..... N84-15398
N84-15401
N84-15684
N84-15685
N84-15686
AF PROJ. 3201 ..... N84-15502
AF PROJ. 3205 ..... N84-15816
AF PROJ. 4519 ..... N84-15373
AF PROJ. 4600 ..... N84-15995
AF PROJ. 6430 ..... N84-15366
AF PROJ. 7231 ..... N84-15822
AF PROJ. 7661 ..... N84-15528
AF PROJ. 7670 ..... N84-16098
AF PROJ. 7757 ..... N84-15756
N84-15760
AF-AFOSR-0019-83 ..... N84-16109
N84-16110
AF-AFOSR-0039-81 ..... N84-15983
AF-AFOSR-0050-82 ..... N84-15773
AF-AFOSR-0061-81 ..... N84-15544
AF-AFOSR-0065-80 ..... N84-15253
AF-AFOSR-0078-81 ..... N84-15779
AF-AFOSR-0122-81 ..... N84-15635
AF-AFOSR-0160-82 ..... N84-15772
AF-AFOSR-0179-81 ..... N84-15776
AF-AFOSR-0186-82 ..... N84-15250
AF-AFOSR-0193-81 ..... N84-15845
AF-AFOSR-0198-81 ..... N84-15846
AF-AFOSR-0201-82 ..... N84-15683
AF-AFOSR-0203-82 ..... N84-15502
AF-AFOSR-0204-82 ..... N84-15125
AF-AFOSR-0221-80 ..... N84-15771
AF-AFOSR-0244-81 ..... N84-15794
AF-AFOSR-3271-77 ..... N84-15812
AF-AFOSR-3695-78 ..... N84-15842
ARPA ORDER 2496 ..... N84-15375
ARPA ORDER 2551 ..... N84-15713
N84-15714
ARPA ORDER 3045 ..... N84-15379
ARPA ORDER 3345 ..... N84-15903
ARPA ORDER 3706 ..... N84-15997
ARPA ORDER 4406 ..... N84-15714
ARPA ORDER 4435 ..... N84-15714
C93/293 ..... N84-15500
DA PROJ. 1L1-6211-AH-71 ..... N84-15964
DA PROJ. 1L1-61101-A-91-A N84-15524
DA PROJ. 1L1-61102-AH-43 ..... N84-15127
N84-15221
N84-15285
DA PROJ. 1L1-61102-AH-45 ..... N84-15199
DA PROJ. 1L1-61102-BH-57 ..... N84-16001
DA PROJ. 1L1-62701-AH-92 ..... N84-15370
DA PROJ. 1T1-61102-BH-57 ..... N84-15853
DA PROJ. 3D30 ..... N84-15903
DA PROJ. 3E1-16777-A-879 ..... N84-15768
DA PROJ. 3E1-62777-A-878 ..... N84-15801
DA PROJ. 3E1-62777-A-879 ..... N84-15523
N84-15769
DA PROJ. 3E1-162777-A-879 ..... N84-15766
DA PROJ. 3M1-62734-A-875 ..... N84-15780
DA PROJ. 3T10 ..... N84-15903
DA PROJ. 4A1-61101-A-91-D N84-15609
DA PROJ. 7930 ..... N84-16068
DAAE07-81-C-4058 ..... N84-15826
DAAG29-77-G-0102 ..... N84-15275
DAAG29-79-C-0085 ..... N84-15873
DAAG29-79-C-0131 ..... N84-15965
DAAG29-79-C-0161 ..... N84-15846
DAAG29-79-D-1002 ..... N84-15225
DAAG29-80-C-0007 ..... N84-15223
DAAG29-80-C-0067 ..... N84-15567
DAAG29-80-C-0114 ..... N84-16001
DAAG29-80-C-0116 ..... N84-16000
DAAG29-80-G-0005 ..... N84-15966
DAAG29-80-K-0020 ..... N84-15950
DAAG29-81-D-0100 ..... N84-15964
DAAG29-82-C-0011 ..... N84-15759
DAAG29-82-K-0013 ..... N84-15381
DAAG29-82-K-0074 ..... N84-15376
DAAG29-82-K-0154 ..... N84-15851
DAAK60-83-C-0031 ..... N84-15765
DAAK70-81-C-0128 ..... N84-15289
DAAK80-81-C-0077 ..... N84-15370
DAAK80-81-C-0089 ..... N84-15643
N84-15817
DACW39-82-M-1125 ..... N84-15716
DAJA37-80-C-0234 ..... N84-15853
DAJA37-81-C-0223 ..... N84-15545
DAJA37-81-C-0251 ..... N84-15899
DAJA45-82-C-0004 ..... N84-15715
DAMD17-81-C-1057 ..... N84-15766
N84-15768
DARPA ORDER 2496 ..... N84-15377
N84-15378
DARPA ORDER 3650 ..... N84-15543
DARPA ORDER 3654 ..... N84-15181
DARPA ORDER 3862 ..... N84-15642
DARPA ORDER 4114 ..... N84-15823
DE-AC02-76CH-00016 ..... N84-15906
N84-15907
N84-15908
N84-15915
N84-15921
N84-15924
N84-15935
N84-15939
N84-15953
N84-16011
DE-AC02-76CH-03000 ..... N84-15892
DE-AC02-76EV-01105 ..... N84-15761
DE-AC02-76EV-03490 ..... N84-15785
DE-AC02-77CH-00178 ..... N84-15423
N84-15678
N84-15689
N84-15691
N84-15905
DE-AC02-81RA-50292 ..... N84-15404
DE-AC02-87CH-10093 ..... N84-15276
DE-AC03-76SF-00098 ..... N84-15782
N84-15910
N84-15911
N84-16009
N84-16019
DE-AC03-76SF-00515 ..... N84-15955
N84-16018
DE-AC04-76DP-00053 ..... N84-15227
DE-AC04-76DP-00789 ..... N84-15128
N84-15129
N84-15258
N84-15260
N84-15403
N84-15406
N84-15613
N84-15717
N84-16004
N84-16006
N84-16008
DE-AC04-76DP-03533 ..... N84-15296
N84-15297
DE-AC04-76DP-000613 ..... N84-15832
DE-AC04-76EV-01013 ..... N84-15694
DE-AC05-83MA-40000 ..... N84-16082
N84-16083
DE-AC06-76FF-02170 ..... N84-15254
N84-15255
N84-15569
N84-15570
N84-15615
DE-AC06-76RL-01830 ..... N84-15728
N84-16080
DE-AC08-81ER-40048 ..... N84-15954
DE-AC07-76ID-01570 ..... N84-15240
DE-AC09-76SR-00001 ..... N84-15245
N84-15810
DE-AC13-76GJ-01664 ..... N84-15638
DE-AI01-77CS-1040 ..... N84-15554
DE-AI01-77CS-51040 ..... N84-15246
DE-AI08-79DP-40092 ..... N84-15989
N84-15991
DE-AM03-76SF-00767 ..... N84-15278
DE-AS05-76ER-03992 ..... N84-15383
DE-AT03-81ER-10670 ..... N84-15278
DE-FC03-80ER-10692 ..... N84-15358
DE-FG01-80CS-40338 ..... N84-15277
DE-FG01-82CE-15146 ..... N84-15359
DE-FG02-81R5-10326 ..... N84-15551
DE-FG05-80ET-3088 ..... N84-15990
DE-FG05-80ET-53088 ..... N84-15985
N84-15987
N84-15988
DE-FG44-81R4-10406 ..... N84-15291
DEN3-156 ..... N84-15679
DEN3-168 ..... N84-15554
DI-12-14-5001-38 ..... N84-15633
DI-14-34-0001-2135 ..... N84-15645
DNA001-51-C-0010 ..... N84-15650
DOT-FA78WA-4096 ..... N84-15157
N84-15158
DRET-80/493 ..... N84-15468
DRET-82/043 ..... N84-15468
DTFA03-81-C-00059 ..... N84-15150
EG-77-C-01-4042 ..... N84-15676

EMW-C-0835 ..... N84-15678
ESTEC-4099/79/NL-PP N84-15680
ESTEC-4099/79I/NL-PP(SC) N84-15689
ESTEC-4435/80/NL-AK(SC) N84-15905
ESTEC-4793/81/NL-AK-(SC) N84-16062
FG01-81CS-15072 ..... N84-15563
FMV-F-INK-82223-80-183-21-001 ..... N84-15562
F04611-80-C-0052 ..... N84-15182
F04701-82-C-0083 ..... N84-15186
F08606-79-C-0001 ..... N84-15687
F08606-80-C-0016 ..... N84-15132
F08635-82-K-0102 ..... N84-15287
F19628-79-C-0105 ..... N84-15331
F19628-80-C-0002 ..... N84-15713
N84-15714
F19628-80-C-0021 ..... N84-15146
F19628-80-C-0031 ..... N84-15999
F19628-80-C-0064 ..... N84-15366
F19628-80-C-0076 ..... N84-15903
F19628-80-C-0130 ..... N84-15639
F19628-80-C-0205 ..... N84-15527
F19628-81-C-0001 ..... N84-15659
F19628-81-C-0141 ..... N84-16098
F19628-82-C-0067 ..... N84-15995
F30602-80-C-0285 ..... N84-15528
F30602-81-C-0035 ..... N84-15368
F30602-81-C-0194 ..... N84-15735
F30602-82-C-0009 ..... N84-15998
F33615-79-C-3402 ..... N84-15372
F33615-79-C-5101 ..... N84-15816
F33615-80-C-0612 ..... N84-15181
F33615-80-C-2041 ..... N84-15373
N84-15344
N84-15274
N84-15756
N84-15684
N84-15685
N84-15686
F33615-80-C-2075 ..... N84-15398
F33615-80-C-3623 ..... N84-15160
F33615-81-C-0513 ..... N84-15822
F33615-81-C-1437 ..... N84-15380
F33615-81-C-2078 ..... N84-15401
F33615-81-K-3225 ..... N84-15206
F33615-82-C-0013 ..... N84-15839
F33615-82-C-5076 ..... N84-15994
F41000 ..... N84-15148
F49620-81-C-0013 ..... N84-15943
F49620-81-C-0016 ..... N84-15946
F49620-81-C-0055 ..... N84-15775
F49620-82-C-0009 ..... N84-15847
N84-15867
N84-15868
F49620-82-C-0018 ..... N84-16064
F49620-82-K-0017 ..... N84-15838
N84-16063
F49620-82-K-0024 ..... N84-15770
F61541 ..... N84-15556
F41400000 ..... N84-15137
ISEA-2E/000 ..... N84-15572
JHO/1033 ..... N84-15971
MDA903-77-C-0272 ..... N84-15375
N84-15377
N84-15378
MDA903-79-C-0588 ..... N84-15542
MDA903-80-C-0476 ..... N84-15363
MDA903-81-C-0166 ..... N84-16077
MDA903-81-C-0578 ..... N84-15997
MDA903-82-C-0064 ..... N84-15377
N84-15378
MDA903-83-C-0053 ..... N84-15823
MIPR-FY71218200015 ..... N84-15272
MO-A01-78-00-4092 ..... N84-15671
MRI PROJ. 7541-D N84-16062
NAGW-14 ..... N84-16095
N84-16096
NAG1-227 ..... N84-15268
NAG2-189 ..... N84-15877
NAG2-203 ..... N84-15877
NAG3-9 ..... N84-15360
NAG3-32 ..... N84-15589
NAG3-219 ..... N84-15681
NAG3-328 ..... N84-15565
NAG5-49 ..... N84-15628
NAG5-77 ..... N84-15631
NAG5-131 ..... N84-15632
NAG8-446 ..... N84-16112
NASW-3504 ..... N84-15972
NASW-3541 ..... N84-15116
N84-15122
N84-15124
N84-15519
N84-15552
N84-15789
NASW-3542 ..... N84-15118
N84-15119
N84-15143
N84-15248
N84-15270
N84-15553
N84-15709
N84-15980
N84-15981
NASW-3690 ..... N84-15972
NAS1-14101 ..... N84-15811
NAS1-14472 ..... N84-15811
NAS1-15357 ..... N84-15115
NAS1-15810 ..... N84-15462
N84-15811
NAS1-16394 ..... N84-15811
N84-15896
NAS1-16535 ..... N84-15425
NAS1-16612 ..... N84-15123
NAS1-17070 ..... N84-15811
N84-15897
NAS1-17130 ..... N84-15811
N84-15896
N84-15897
NAS2-9482 ..... N84-15972
NAS2-11052 ..... N84-15135
NAS2-11277 ..... N84-15114
NAS3-20073 ..... N84-15247
NAS3-22003 ..... N84-15151
NAS3-22063 ..... N84-15283
NAS3-22245 ..... N84-15682
NAS3-22533 ..... N84-15153
N84-15154
NAS3-23525 ..... N84-15152
N84-15155
N84-15156
NAS5-2062 ..... N84-15972
NAS5-11437 ..... N84-15711
NAS5-20682 ..... N84-15909
N84-15972
NAS5-25030 ..... N84-15708
NAS5-25172 ..... N84-15345
NAS5-25543 ..... N84-15173
NAS5-25792 ..... N84-15957
NAS5-25977 ..... N84-15627
NAS5-26249 ..... N84-15673
NAS5-26753 ..... N84-16071
N84-16073
N84-16074
NAS5-27343 ..... N84-15555
NAS5-27382 ..... N84-15633
NAS5-27393 ..... N84-16072
NAS5-27595 ..... N84-15626
NAS7-100 ..... N84-15536
N84-15537
N84-15648
NAS7-918 ..... N84-15168
N84-15348
N84-15354
NAS8-31958 ..... N84-15706
NAS8-32712 ..... N84-15171
NAS8-33272 ..... N84-16097
NAS8-33575 ..... N84-15755
NAS8-33978 ..... N84-15267
NAS8-33980 ..... N84-15521
N84-15522
NAS8-34502 ..... N84-15178
N84-15866
NAS8-34504 ..... N84-15284
N84-15428
NAS8-34744 ..... N84-15732
NAS8-34767 ..... N84-15729
NAS8-34901 ..... N84-15165
NAS8-34943 ..... N84-15959
NAS9-16067 ..... N84-15174
N84-15175
N84-15176
N84-15177
NB80-SBCA-0450 ..... N84-15820
NCC5-21 ..... N84-15708
NGL-05-007-190 ..... N84-15909
NGT-01-005-021 ..... N84-16022
NIH-HL-14965 ..... N84-15786
N84-15768
NR PROJ. 042-467 ..... N84-15848
NR PROJ. 047-033 ..... N84-16065
NR PROJ. 049-383 ..... N84-15379
NR PROJ. 056-703 ..... N84-15951
NR PROJ. 092-549 ..... N84-15949
NR PROJ. 097-457 ..... N84-16017
NR PROJ. 196-165 ..... N84-15809
NR PROJ. 359-650 ..... N84-15397
NR PROJ. 627-838 ..... N84-15224
NSF AR-75-08154 ..... N84-15849
NSF ATM-82-08931 ..... N84-15664
NSF DEB-81-15316 ..... N84-15739
NSF ECS-79-23893 ..... N84-15804
NSF ECS-80-07102 ..... N84-15901
NSF ECS-82-05425 ..... N84-15852
NSF ENG-79-02506 ..... N84-15852
NSF MCS-79-23110 ..... N84-15792
NSF MCS-82-05355 ..... N84-15846
NSF OCE-80-19448 ..... N84-15739
NSF PHY-80-22530 ..... N84-15910
NSG-1297 ..... N84-15196
NSG-1607 ..... N84-15587
NSG-5049 ..... N84-15535
N84-15674
NSG-5134 ..... N84-15629
NSG-5205 ..... N84-15730
NSG-7324 ..... N84-15520
NSG-7339 ..... N84-16095
NSG-7610 ..... N84-15710
N00014-75-C-0154 ..... N84-15252
N00014-75-C-0455 ..... N84-15869
N84-15870
N84-15871
N00014-75-C-0541 ..... N84-15222
N00014-75-C-0661 ..... N84-15827
N00014-75-C-0690 ..... N84-15949
N00014-75-C-0887 ..... N84-15996
N00014-75-C-1183 ..... N84-15379
N00014-76-C-0004 ..... N84-15640
N00014-76-C-0134 ..... N84-16065
N00014-76-C-0197 ..... N84-15745
N00014-76-C-0475 ..... N84-15844
N00014-76-C-0838 ..... N84-15982
N00014-76-C-1092 ..... N84-15815
N00014-77-C-0489 ..... N84-15671
N00014-78-C-0566 ..... N84-15673
N00014-78-C-04444 ..... N84-15400
N00014-79-C-0044 ..... N84-15951
N00014-79-C-0650 ..... N84-15848
N00014-79-C-0682 ..... N84-15220
N00014-80-C-0077 ..... N84-15753
N00014-80-C-0093 ..... N84-15874
N00014-80-C-0219 ..... N84-15902
N00014-80-C-0402 ..... N84-15791
N00014-80-C-0472 ..... N84-15193
N84-15942
N00014-80-C-0493 ..... N84-15809
N00014-80-C-0505 ..... N84-15792
N84-15878
N00014-80-C-0614 ..... N84-15541
N84-15542
N84-15546
N00014-81-C-0443 ..... N84-15162
N00014-81-K-0048 ..... N84-16059
N84-16061
N84-16066
N84-16067
N00014-81-K-0301 ..... N84-15568
N00014-81-K-0314 ..... N84-15872
N00014-81-K-0503 ..... N84-15802
N84-15803
N00014-81-K-0624 ..... N84-15757
N00014-81-K-0718 ..... N84-15944
N00014-81-K-0742 ..... N84-15901
N00014-81-K-0814 ..... N84-15362
N00014-81-M-0058 ..... N84-15559
N00014-82-C-0038 ..... N84-15754
N00014-82-C-0057 ..... N84-15543
N00014-82-C-0152 ..... N84-15901
N00014-82-C-0394 ..... N84-15751
N00014-82-C-0671 ..... N84-16017
N00014-82-C-0761 ..... N84-15752
N00014-82-C-2361 ..... N84-16002
N00014-82-F-0040 ..... N84-15334
N00014-82-F-0077 ..... N84-15397
N00014-82-G-0016 ..... N84-15712
N00014-82-K-0329 ..... N84-15652
N00014-82-K-0612 ..... N84-15224
N00014-82-K-0714 ..... N84-15813
N84-15825
N00014-83-K-0021 ..... N84-15790
N00014-83-K-0059 ..... N84-15850
N00019-79-C-0574 ..... N84-15610
N00019-81-C-0179 ..... N84-15205
N00019-81-C-0424 ..... N84-15365
N00019-81-C-0550 ..... N84-15251
N00024-79-C-6043 ..... N84-15904
N00024-83-C-5301 ..... N84-15371
N00039-79-Z-0169 ..... N84-15849
N00173-80-C-0265 ..... N84-15526
N00228-82-C-6199 ..... N84-15671
N60921-79-C-0180 ..... N84-15540
N61339-77-C-0110 ..... N84-15808
N62269-81-C-0744 ..... N84-15782
N62269-82-M-3208 ..... N84-15784
N62269-82-M-3270 ..... N84-15783
PROJ. AGRISTARS N84-15635
N84-15636
N84-15637
PROJ. 2304 ..... N84-15812

RR02105 ..... N84-15369
RR011094E N84-15947
RR0110941 ..... N84-15945
RR0130844 ..... N84-15961
RR0240302 ..... N84-16017
RR0330244 ..... N84-15948
SF6154101 ..... N84-15204
SF12131691 ..... N84-15367
SF32290492 ..... N84-15540
SR0230101 ..... N84-15506
SSI/P103 ..... N84-15786
S0384SL N84-15538
U99QMDM N84-15760
W-31-109-ENG-38 ..... N84-15508
N84-15614
N84-15956
N84-16013
N84-16015
W-7405-ENG-26 ..... N84-15187
N84-15256
N84-15257
N84-15548
N84-15560
N84-15677
N84-15693
N84-15739
N84-15799
N84-15836
N84-15865
N84-15979
N84-15984
N84-15986
N84-16005
W-7405-ENG-36 ..... N84-15197
N84-15290
N84-15292
N84-15402
N84-15405
N84-15510
N84-15511
N84-15561
N84-15718
N84-15719
N84-15854
N84-15967
N84-15977
N84-15978
N84-16003
N84-16007
N84-16012
N84-16014
N84-16081
N84-16105
N84-16114
W-7405-ENG-48 ..... N84-15226
N84-15259
N84-15382
N84-15509
N84-15547
N84-15612
N84-15688
N84-15737
N84-15818
N84-15831
N84-15968
N84-16102
W-7405-ENG-82 ..... N84-15279
N84-16010
XR01405800 ..... N84-15396
X10630 ..... N84-15364
ZR00001 ..... N84-15374
ZR00001179 ..... N84-15843
505-31-01 ..... N84-15114
505-31-32 ..... N84-15894
505-33-33-05 ..... N84-15200
N84-15201
505-34-13 ..... N84-15898
505-35-01 ..... N84-15135
505-42-23-09 ..... N84-15117
505-43-31 ..... N84-15588
505-43-43-01 ..... N84-15145
506-51-13-02 ..... N84-15179
506-53-1A N84-15565
506-58-22 ..... N84-15394
510-53-12 ..... N84-15247
533-02-61 ..... N84-15159
533-042-1A N84-15156
778-35-03 ..... N84-15246

REPORT / ACCESSION NUMBER INDEX

Typical Report / Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

ACI-111483-FR ..... N84-15732* #

AD-A126702 ..... N84-15683 #
AD-A126703 ..... N84-15125 #
AD-A126788 ..... N84-15502 #
AD-A129365 ..... N84-15800 #
AD-A129367 ..... N84-15899 #
AD-A129389 ..... N84-15821 #
AD-A130627 ..... N84-15733 #
AD-A130658 ..... N84-15766 #
AD-A130827 ..... N84-15766 #
AD-A130838 ..... N84-15767 #
AD-A130849 ..... N84-15136 #
AD-A130881 ..... N84-15765 #
AD-A131015 ..... N84-15790 #
AD-A132616 ..... N84-15780 #
AD-A132649 ..... N84-15781 #
AD-A132653 ..... N84-15148 #
AD-A132746 ..... N84-15782 #
AD-A132747 ..... N84-15783 #
AD-A132748 ..... N84-15784 #
AD-A132825 ..... N84-16066 #
AD-A132831 ..... N84-15759 #
AD-A132841 ..... N84-16059 #
AD-A132859 ..... N84-16067 #
AD-A132893 ..... N84-15716 #
AD-A132898 ..... N84-16068 #
AD-A132941 ..... N84-15760 #
AD-A133051 ..... N84-15754 #
AD-A133052 ..... N84-15796 #
AD-A133093 ..... N84-15797 #
AD-A133110 ..... N84-15961 #
AD-A133113 ..... N84-15757 #
AD-A133114 ..... N84-15994 #
AD-A133119 ..... N84-15753 #
AD-A133123 ..... N84-15995 #
AD-A133127 ..... N84-15556 #
AD-A133128 ..... N84-15361 #
AD-A133136 ..... N84-15639 #
AD-A133137 ..... N84-15900 #
AD-A133139 ..... N84-15503 #
AD-A133141 ..... N84-15362 #
AD-A133142 ..... N84-15843 #
AD-A133145 ..... N84-15363 #
AD-A133148 ..... N84-15758 #
AD-A133150 ..... N84-15777 #
AD-A133152 ..... N84-15982 #
AD-A133153 ..... N84-15844 #
AD-A133156 ..... N84-15901 #
AD-A133158 ..... N84-15557 #
AD-A133161 ..... N84-15033 #
AD-A133167 ..... N84-15184 #
AD-A133168 ..... N84-15364 #
AD-A133173 ..... N84-15523 #
AD-A133174 ..... N84-15801 #
AD-A133181 ..... N84-15524 #
AD-A133183 ..... N84-15942 #
AD-A133186 ..... N84-15943 #
AD-A133187 ..... N84-15996 #
AD-A133188 ..... N84-15126 #
AD-A133189 ..... N84-15845 #

AD-A133201 ..... N84-15802 #
AD-A133202 ..... N84-15220 #
AD-A133203 ..... N84-15365 #
AD-A133206 ..... N84-15251 #
AD-A133207 ..... N84-15803* #
AD-A133208 ..... N84-15140 #
AD-A133209 ..... N84-15396 #
AD-A133211 ..... N84-15538 #
AD-A133212 ..... N84-15127 #
AD-A133213 ..... N84-15221 #
AD-A133215 ..... N84-15285 #
AD-A133221 ..... N84-15778 #
AD-A133222 ..... N84-15150 #
AD-A133233 ..... N84-15137 #
AD-A133236 ..... N84-15867 #
AD-A133238 ..... N84-15162 #
AD-A133239 ..... N84-15823 #
AD-A133241 ..... N84-15366 #
AD-A133242 ..... N84-15286 #
AD-A133245 ..... N84-15902 #
AD-A133248 ..... N84-15812 #
AD-A133250 ..... N84-15903 #
AD-A133251 ..... N84-15525 #
AD-A133252 ..... N84-15846 #
AD-A133253 ..... N84-15868 #
AD-A133254 ..... N84-15944 #
AD-A133258 ..... N84-15539 #
AD-A133260 ..... N84-15847 #
AD-A133264 ..... N84-15813 #
AD-A133266 ..... N84-15904 #
AD-A133272 ..... N84-15684 #
AD-A133274 ..... N84-15160 #
AD-A133279 ..... N84-15367 #
AD-A133281 ..... N84-15397 #
AD-A133282 ..... N84-15793 #
AD-A133285 ..... N84-16062 #
AD-A133286 ..... N84-15368 #
AD-A133287 ..... N84-15848 #
AD-A133288 ..... N84-15962 #
AD-A133289 ..... N84-15504 #
AD-A133290 ..... N84-15398 #
AD-A133291 ..... N84-15945 #
AD-A133295 ..... N84-15540 #
AD-A133296 ..... N84-16063 #
AD-A133297 ..... N84-15814 #
AD-A133298 ..... N84-15804 #
AD-A133299 ..... N84-15849 #
AD-A133301 ..... N84-15185 #
AD-A133305 ..... N84-15204 #
AD-A133310 ..... N84-15946 #
AD-A133319 ..... N84-15146 #
AD-A133321 ..... N84-15541 #
AD-A133322 ..... N84-15542 #
AD-A133325 ..... N84-15399 #
AD-A133326 ..... N84-16058 #
AD-A133327 ..... N84-15543 #
AD-A133328 ..... N84-15566 #
AD-A133330 ..... N84-15526 #
AD-A133331 ..... N84-15205 #
AD-A133334 ..... N84-15544 #
AD-A133335 ..... N84-15963 #
AD-A133336 ..... N84-15869 #
AD-A133337 ..... N84-15947 #
AD-A133338 ..... N84-15948 #
AD-A133364 ..... N84-15287 #
AD-A133367 ..... N84-15369 #
AD-A133369 ..... N84-15288 #
AD-A133370 ..... N84-15640 #
AD-A133371 ..... N84-15370 #
AD-A133372 ..... N84-15815 #
AD-A133380 ..... N84-15138 #
AD-A133383 ..... N84-15222 #
AD-A133385 ..... N84-15824 #
AD-A133386 ..... N84-15157 #
AD-A133387 ..... N84-15870 #
AD-A133389 ..... N84-16077 #
AD-A133391 ..... N84-15949 #
AD-A133399 ..... N84-15169 #
AD-A133401 ..... N84-15371 #
AD-A133402 ..... N84-15997* #
AD-A133403 ..... N84-15272 #
AD-A133404 ..... N84-16064 #
AD-A133405 ..... N84-15871 #

AD-A133406 ..... N84-15850 #
AD-A133408 ..... N84-15158 #
AD-A133411 ..... N84-15181 #
AD-A133415 ..... N84-15147 #
AD-A133416 ..... N84-15851 #
AD-A133417 ..... N84-15838 #
AD-A133418 ..... N84-15872 #
AD-A133420 ..... N84-15223 #
AD-A133424 ..... N84-15567 #
AD-A133426 ..... N84-15816 #
AD-A133427 ..... N84-15372 #
AD-A133432 ..... N84-15357 #
AD-A133438 ..... N84-15805 #
AD-A133439 ..... N84-15545 #
AD-A133440 ..... N84-15273 #
AD-A133447 ..... N84-15825 #
AD-A133448 ..... N84-15806 #
AD-A133449 ..... N84-15950 #
AD-A133451 ..... N84-15558 #
AD-A133458 ..... N84-15873 #
AD-A133459 ..... N84-15826 #
AD-A133460 ..... N84-15252 #
AD-A133461 ..... N84-15141 #
AD-A133462 ..... N84-15983 #
AD-A133468 ..... N84-15505 #
AD-A133475 ..... N84-15559 #
AD-A133477 ..... N84-15827 #
AD-A133479 ..... N84-15274 #
AD-A133480 ..... N84-16078 #
AD-A133482 ..... N84-15674 #
AD-A133483 ..... N84-15641 #
AD-A133485 ..... N84-15206 #
AD-A133486 ..... N84-15373 #
AD-A133487 ..... N84-15568 #
AD-A133489 ..... N84-15964 #
AD-A133490 ..... N84-15207 #
AD-A133491 ..... N84-15400 #
AD-A133492 ..... N84-15807 #
AD-A133493 ..... N84-15828 #
AD-A133495 ..... N84-15642 #
AD-A133498 ..... N84-15374 #
AD-A133500 ..... N84-15998 #
AD-A133501 ..... N84-15685 #
AD-A133504 ..... N84-15852 #
AD-A133506 ..... N84-15734 #
AD-A133507 ..... N84-15808 #
AD-A133508 ..... N84-15546 #
AD-A133509 ..... N84-16017 #
AD-A133513 ..... N84-15999 #
AD-A133514 ..... N84-15686 #
AD-A133516 ..... N84-15951 #
AD-A133517 ..... N84-15506 #
AD-A133518 ..... N84-15809 #
AD-A133519 ..... N84-15224 #
AD-A133525 ..... N84-15375 #
AD-A133527 ..... N84-15275 #
AD-A133528 ..... N84-15376 #
AD-A133529 ..... N84-15829 #
AD-A133530 ..... N84-15965 #
AD-A133541 ..... N84-15225 #
AD-A133543 ..... N84-15269 #
AD-A133544 ..... N84-15794 #
AD-A133545 ..... N84-15835 #
AD-A133552 ..... N84-15527 #
AD-A133553 ..... N84-16098 #
AD-A133554 ..... N84-15377 #
AD-A133555 ..... N84-15378 #
AD-A133556 ..... N84-16000 #
AD-A133557 ..... N84-15735 #
AD-A133558 ..... N84-16079 #
AD-A133559 ..... N84-15830 #
AD-A133569 ..... N84-16001 #
AD-A133570 ..... N84-15401 #
AD-A133571 ..... N84-16085 #
AD-A133572 ..... N84-15379 #
AD-A133574 ..... N84-15714 #
AD-A133575 ..... N84-15966 #
AD-A133576 ..... N84-15853 #
AD-A133587 ..... N84-15380 #
AD-A133588 ..... N84-15528 #
AD-A133590 ..... N84-15643 #
AD-A133591 ..... N84-15817 #
AD-A133592 ..... N84-15839 #

AD-A133593 N84-16002 #
AD-A133595 N84-15715 #
AD-A133596 N84-15510 #
AD-A133597 N84-15779 #
AD-A133598 N84-15253 #
AD-A133600 N84-15611 #
AD-A133601 N84-15381 #
AD-A133602 N84-15795 #
AD-A133603 N84-15193 #
AD-A133614 N84-15878 #
AD-A133617 N84-15170 #
AD-A133618 N84-15736 #
AD-A133620 N84-16113 #
AD-A133634 N84-15792 #
AD-A133668 N84-16110 #
AD-A133694 N84-15776 #
AD-A133720 N84-15822 #
AD-A133740 N84-15775 #
AD-A133753 N84-15752 #
AD-A133754 N84-15751 #
AD-A133812 N84-15750 #
AD-A133871 N84-15791 #
AD-A133873 N84-15250 #
AD-A133877 N84-15749 #
AD-A133881 N84-15774 #
AD-A133906 N84-15609 #
AD-A133907 N84-16109 #
AD-A133908 N84-15773 #
AD-A133917 N84-15772 #
AD-A133928 N84-15771 #
AD-A133939 N84-15748 #
AD-A133940 N84-15747 #
AD-A133952 N84-15770 #
AD-A133995 N84-15746 #
AD-A134005 N84-15745 #
AD-A134036 N84-15713 #
AD-A134071 N84-15744 #
AD-A134074 N84-16061 #
AD-A134077 N84-15712 #
AD-A134079 N84-15756 #
AD-A134086 N84-15769 #
AD-A134104 N84-15842 #
AD-A134579 N84-15121 #

AD-E000543 N84-15396 #
AD-E000545 N84-15538 #
AD-E000546 N84-15140 #
AD-E000546 N84-15220 #
AD-E000546 N84-15251 #
AD-E000546 N84-15365 #
AD-E000546 N84-15802 #
AD-E000546 N84-15803* #
AD-E750844 N84-15273 #
AD-E750844 N84-15545 #
AD-E750844 N84-15805 #
AD-E750854 N84-15904 #
AD-E950432 N84-15169 #
AD-E950445 N84-15869 #
AD-E950445 N84-15947 #
AD-E950445 N84-15948 #
AD-E950445 N84-15963 #
AD-E950446 N84-15870 #
AD-E950446 N84-15949 #
AD-E950446 N84-16077 #

AD-F300311 N84-15265 #
AD-F300312 N84-15221 #
AD-F300314 N84-15127 #
AD-F300330 N84-15751 #
AD-F300330 N84-15752 #

AEDC-TR-83-33 N84-15525 #
AEDC-TR-83-37 N84-15504 #

AERE-TR-4774 N84-15244 #

AFAMRL-TR-83-058 N84-15822 #

AFESC/ESL-TR-82-47 N84-15146 #

AFGL-TR-83-0081 N84-15528 #
AFGL-TR-83-0099 N84-16098 #
AFGL-TR-83-0105 N84-15639 #
AFGL-TR-83-0133 N84-15735 #
AFGL-TR-83-0137 N84-15527 #

AFHRL-TP-83-28 N84-15839 #

AFOSR-83-0743TR N84-15946 #
AFOSR-83-0746TR N84-15845 #
AFOSR-83-0747TR N84-15943 #
AFOSR-83-0772TR N84-15846 #
AFOSR-83-0773TR N84-15868 #
AFOSR-83-0775TR N84-15867 #
AFOSR-83-0776TR N84-15847 #
AFOSR-83-0781TR N84-15842 #
AFOSR-83-0782TR N84-15812 #
AFOSR-83-0783TR N84-15544 #
AFOSR-83-0794TR N84-15983 #
AFOSR-83-0807TR N84-15779 #
AFOSR-83-0808TR N84-15775 #
AFOSR-83-0826TR N84-15250 #
AFOSR-83-0827TR N84-15253 #
AFOSR-83-0831TR N84-15773 #
AFOSR-83-0832TR N84-15770 #
AFOSR-83-0834TR N84-15776 #
AFOSR-83-0843TR N84-16109 #
AFOSR-83-0848TR N84-16110 #
AFOSR-83-0854TR N84-15772 #
AFOSR-83-0859TR N84-15771 #

AFRPL-TR-83-034 N84-15267 #

AFWAL-TR-82-312 N84-15121 #
AFWAL-TR-82-1147-VOL-1 N84-15380 #
AFWAL-TR-82-2019-VOL-2 N84-15684 #
AFWAL-TR-82-2019-VOL-3 N84-15685 #
AFWAL-TR-82-2019-VOL-4 N84-15686 #
AFWAL-TR-82-2049 N84-15398 #
AFWAL-TR-83-2049 N84-15401 #
AFWAL-TR-83-3013 N84-15733 #
AFWAL-TR-83-3041 N84-15160 #
AFWAL-TR-83-3084-VOL-1 N84-15206 #
AFWAL-TR-83-4061 N84-15207 #
AFWAL-TR-83-4063 N84-15274 #
AFWAL-TR-83-4067 N84-15994 #

AGARD-AG-270(FR) N84-15788 #
AGARD-AG-283(ENG) N84-15787 #
AGARD-AG-283(FR) N84-15787 #
AGARD-AG-300-VOL-1 N84-15530 #

AGARD-CP-343 N84-15034 #
AGARD-CP-345 N84-15646 #
AGARD-CP-347 N84-15076 #

AI-M-723 N84-15792 #
AI-M-727 N84-15878 #

AIAA-83-1825 N84-15145* #

AMMRC-TR-83-39 N84-15524 #

AMRC-R-466 N84-15946 #

ANL-HEP-CP-82-64 N84-16015

ANL-83-10 N84-15614 #
ANL-83-87 N84-15508 #

APL-UW-8310 N84-15754 #

AR-2 N84-15899 #

ARBRL-IMR-74 N84-15127 #

ARBRL-MR-03300 N84-15285 #

ARBRL-TR-02512 N84-15221 #
ARBRL-TR-02515 N84-15127 #

ARCSL-TR-83022 N84-15539 #

ARL/PSU/TM-83-95 N84-15904 #

ARL/STRUC-TM-362 N84-15147 #

ARO-16487.1-EL N84-16001 #
ARO-16492.3-PH N84-15223 #
ARO-16512.2-GS N84-15965 #
ARO-16539.6-MA N84-15873 #
ARO-16862.4-EG N84-15275 #
ARO-17074.13-MA N84-15567 #
ARO-17090.3-PH N84-16000 #
ARO-17349.2-CH N84-15950 #
ARO-17441.7-GS N84-15381 #
ARO-17775.3-PH-H N84-15966 #
ARO-18782.5-CH N84-15225 #
ARO-18828.1-LS-S N84-15759 #
ARO-18986.3-EL N84-15376 #
ARO-19298.3-MA N84-15851 #

AS-TR-459-4 N84-15817 #
AS-TR-459-5 N84-15643 #

ATC-R-92000/3CR-9 N84-15205 #

ATR-2 N84-15757 #

AVAA-TR-81-0089-5 N84-15643 #

BDM/W-83-444-TR N84-15823 #

BDX-613-2981 N84-15832 #

BLL-CE-TRANS-7949-(9022.09) N84-15583 #
BLL-CE-TRANS-8000-(9022.09) N84-15550 #

BLL-DRIC-T-6968-(3623.66) N84-15549 #
BLL-DRIC-T-6970-(3623.66) N84-15517 #

BLL-M-35267-(5828.4) N84-15564 #
BLL-M-35268-(5828.4) N84-15584 #
BLL-M-35271-(5828.4) N84-15231 #
BLL-M-35284-(5828.4) N84-15232 #
BLL-M-35287-(5828.4) N84-15574 #
BLL-M-35292-(5828.4) N84-15233 #
BLL-M-35293-(5828.4) N84-15234 #
BLL-M-35295-(5828.4) N84-15695 #

BLL-OA-TRANS-3037-(6196.3) N84-15213 #
BLL-OA-TRANS-3066-(6196.3) N84-15238 #
BLL-OA-TRANS-3082-(6196.3) N84-15237 #
BLL-OA-TRANS-3095-(6196.3) N84-15239 #
BLL-OA-TRANS-3111-(6L96.3) N84-15241 #

BLL-RARDE-TR-1094(7291.7965) N84-15236 #

BLL-T6213/BG/LRS/LRST671/83 N84-15212 #

BLL-WINDSCALE-TR-959-(9091.F) N84-15235 #

BM-IC-8928 N84-15228 #

BNL-32343 N84-15907
BNL-32344 N84-15908
BNL-33016 N84-15906
BNL-33600 N84-16011 #
BNL-33685 N84-15953 #

BR89447 N84-15517 #
BR89448 N84-15549 #

CA-8311 N84-15198 #
CA-8313 N84-15219 #
CA-8316 N84-15218 #

CAR-TR-1 N84-15812 #

CAR-83-1 N84-15522* #
CAR-83-2 N84-15521* #

CARE-83-3 N84-15790 #

CECOM-81-C-0077-F N84-15370 #

CERC-83-1 N84-15744 #

CERL-TR-M-333 N84-15273 #

CERL-TR-N-163 N84-16078 #

CERT-5/6047-DERO N84-15529 #

CGR/DC-3/83 N84-15138 #

CISE-2057 N84-15837 #
CISE-2072 N84-15571 #
CISE-2075 N84-15572 #

CMU-RI-TR-82-16 N84-15566 #
CMU-RI-TR-83-4 N84-15849 #
CMU-RI-TR-83-6 N84-15804 #
CMU-RI-TR-83-7 N84-15614 #
CMU-RI-TR-83-8 N84-16063 #
CMU-RI-TR-83-11 N84-15805 #
CMU-RI-TR-83-12 N84-15838 #
CMU-RI-TR-83-13 N84-15806 #
CMU-RI-TR-83-14 N84-15807 #

CONF-820134-1 N84-15677 #
CONF-821049-25 N84-15257 #
CONF-821054-2 N84-15739 #
CONF-821123-33 N84-15907
CONF-821123-36 N84-15908
CONF-830224 N84-15911 #
CONF-830368-1 N84-15906
CONF-830368-3 N84-16018 #
CONF-830405-5 N84-15423
CONF-830405-8 N84-15676 #
CONF-830405-12 N84-15678 #
CONF-830406-111 N84-15968 #
CONF-830451-24 N84-15279 #
CONF-830456-3 N84-16009 #
CONF-830485-1 N84-15570 #
CONF-830622-21 N84-15728
CONF-830622-27 N84-15905 #
CONF-830706-1 N84-15956 #
CONF-830707-6 N84-15693 #

CONF-830708-6 ..... N84-16005 #
CONF-830756-1 ..... N84-16013 #
CONF-830783-13 ..... N84-16012 #
CONF-830782-2 ..... N84-15762 #
CONF-830797-2 ..... N84-16114 #
CONF-830805-60 ..... N84-15240 #
CONF-830808-13 ..... N84-16019 #
CONF-830812-59 ..... N84-15560 #
CONF-830839-2 ..... N84-15691 #
CONF-830841-24 ..... N84-16011 #
CONF-830841-27 ..... N84-15955 #
CONF-830845-5 ..... N84-15258 #
CONF-830874-22 ..... N84-15799 #
CONF-830950-3 ..... N84-16080 #
CONF-830970-3 ..... N84-15954 #
CONF-831015-11 ..... N84-15405 #
CONF-831025-23 ..... N84-15227 #
CONF-831025-24 ..... N84-15548 #
CONF-831026-4 ..... N84-15690 #
CONF-831093-2 ..... N84-15404 #
CONF-831111-5 ..... N84-15818 #
CONF-831171-13 ..... N84-15953 #
CONF-831187-1 ..... N84-16010 #
CONF-831193-1 ..... N84-15832 #
CONF-831194-1 ..... N84-16007 #
CONF-831198-1 ..... N84-15810 #
CONF-831243-1 ..... N84-16006 #
CONF-8105139-14 ..... N84-15256 #
CONF-8206116-25 ..... N84-16015
CONF-8207100-1 ..... N84-16102 #
CONF-8209111 ..... N84-15266 #
CONF-8304129-1 ..... N84-15128 #
CONF-8304129-3 ..... N84-15129 #
CONF-8305110-5 ..... N84-15854 #
CONF-8308132-1 ..... N84-16003 #
CONF-8308133-1 ..... N84-16014 #
CONF-8308136-1 ..... N84-15718 #
CONF-8309100-1 ..... N84-15260 #
CONF-8309167-2 ..... N84-15785 #
CONF-8309169-1 ..... N84-15954 #
CONF-8309170-1 ..... N84-15255 #
CONF-8309170-3 ..... N84-15615 #
CONF-8309170-4 ..... N84-15254 #
CONF-8309176-1 ..... N84-16105 #
CONF-8310148-9 ..... N84-15290 #
CONF-8310148-11 ..... N84-15510 #
CONF-8310169-1 ..... N84-16008 #
CONF-8310177-2 ..... N84-15511 #
CONF-8310178-2 ..... N84-15509 #
CONF-8310182-1 ..... N84-16081 #
CONF-8310188-1 ..... N84-16004 #
CONF-8310194-1 ..... N84-15403 #
CONF-8310194-2 ..... N84-15406 #
CONF-8310196-1 ..... N84-15569 #
CONF-8310201-1 ..... N84-15226 #
CONF-8310204-1 ..... N84-15719 #
CONF-8310208-1 ..... N84-15831 #
CONF-8311100-1 ..... N84-15737 #

CRC-528 ..... N84-15289 #
CRC-533 ..... N84-15288 #

CRREL-SR-83-23 ..... N84-15272 #

CRREL-83-23 ..... N84-15609 #

CS-TR-1257 ..... N84-15812 #

CSC/TR-83/6003 ..... N84-15526 #

CSIR-SR-CHEM-261 ..... N84-15188 #

CSIR-TRANS-1707 ..... N84-15294 #
CSIR-TRANS-1708 ..... N84-15243 #
CSIR-TRANS-1709 ..... N84-15293 #

CSIR-1712 ..... N84-15242 #

CTIAC-66 ..... N84-15357 #

DAVAA-TR-81-0089-4 ..... N84-15817 #

DC-Y3-04440 ..... N84-15635* #
DC-Y3-04441 ..... N84-15637* #

DE-Y2-04396 ..... N84-15636* #

DE82-011513 ..... N84-15677 #
DE83-004201 ..... N84-15551
DE83-005129 ..... N84-15676 #
DE83-005130 ..... N84-15423
DE83-005353 ..... N84-15638 #
DE83-005791 ..... N84-15908
DE83-005799 ..... N84-15907
DE83-006030 ..... N84-15678 #
DE83-008535 ..... N84-15956 #
DE83-009451 ..... N84-16015
DE83-011566 ..... N84-16009 #
DE83-011706 ..... N84-16013 #
DE83-011931 ..... N84-15614 #
DE83-011960 ..... N84-15680 #
DE83-012131 ..... N84-15691 #
DE83-012146 ..... N84-15570 #
DE83-012610 ..... N84-15694 #
DE83-013114 ..... N84-15906
DE83-013771 ..... N84-15280 #
DE83-014501 ..... N84-15728
DE83-014946 ..... N84-15818 #
DE83-015693 ..... N84-15693 #
DE83-015697 ..... N84-16005 #
DE83-017131 ..... N84-15799 #
DE83-017159 ..... N84-15259 #
DE83-017266 ..... N84-15290 #
DE83-017284 ..... N84-15560 #
DE83-017292 ..... N84-16012 #
DE83-017600 ..... N84-15761 #
DE83-017681 ..... N84-15279 #
DE83-018091 ..... N84-16010 #
DE83-018185 ..... N84-15968 #
DE83-018189 ..... N84-16011 #
DE84-000005 ..... N84-15689 #
DE84-000013 ..... N84-15905 #
DE84-000136 ..... N84-16006 #
DE84-000185 ..... N84-16102 #
DE84-000332 ..... N84-15358 #
DE84-000354 ..... N84-16008 #
DE84-000355 ..... N84-15258 #
DE84-000391 ..... N84-15968 #
DE84-000712 ..... N84-15291 #
DE84-000895 ..... N84-15240 #
DE84-000911 ..... N84-15831 #
DE84-001055 ..... N84-16004 #
DE84-001135 ..... N84-15785 #
DE84-001172 ..... N84-15510 #
DE84-001182 ..... N84-15256 #
DE84-001208 ..... N84-15953 #
DE84-001236 ..... N84-15226 #
DE84-001312 ..... N84-16114 #
DE84-001325 ..... N84-15762 #
DE84-001448 ..... N84-15277 #
DE84-001463 ..... N84-15569 #
DE84-001468 ..... N84-15254 #
DE84-001470 ..... N84-15615 #
DE84-001484 ..... N84-15255 #
DE84-001549 ..... N84-15954 #
DE84-001559 ..... N84-15990 #
DE84-001560 ..... N84-15985 #
DE84-001562 ..... N84-15987 #
DE84-001590 ..... N84-15687 #
DE84-001661 ..... N84-16105 #
DE84-001682 ..... N84-15547 #
DE84-001704 ..... N84-16014 #
DE84-001706 ..... N84-16081 #
DE84-001708 ..... N84-16003 #
DE84-001709 ..... N84-15719 #
DE84-001727 ..... N84-15511 #
DE84-001730 ..... N84-15854 #
DE84-001733 ..... N84-15405 #
DE84-001760 ..... N84-15810 #
DE84-001768 ..... N84-15406 #
DE84-001781 ..... N84-15509 #
DE84-001793 ..... N84-16007 #
DE84-001796 ..... N84-16083 #
DE84-001800 ..... N84-16082 #
DE84-001833 ..... N84-15404 #
DE84-001841 ..... N84-16019 #
DE84-001867 ..... N84-15718 #
DE84-001950 ..... N84-15739 #
DE84-001983 ..... N84-15507 #
DE84-001985 ..... N84-15257 #
DE84-002022 ..... N84-15278 #
DE84-002042 ..... N84-15403 #
DE84-002059 ..... N84-15690 #
DE84-002088 ..... N84-15717 #
DE84-002117 ..... N84-15548 #
DE84-002195 ..... N84-15382 #
DE84-002199 ..... N84-15612 #
DE84-002218 ..... N84-15508 #
DE84-002256 ..... N84-15986 #
DE84-002261 ..... N84-15984 #
DE84-002264 ..... N84-15979 #
DE84-002308 ..... N84-15967 #
DE84-002321 ..... N84-15561 #
DE84-002322 ..... N84-15402 #
DE84-002335 ..... N84-15738 #
DE84-002340 ..... N84-15688 #
DE84-002375 ..... N84-16018 #
DE84-002382 ..... N84-15129 #
DE84-002404 ..... N84-15292 #
DE84-002420 ..... N84-15832 #
DE84-002422 ..... N84-15836 #
DE84-002552 ..... N84-15955 #
DE84-002573 ..... N84-15892 #
DE84-002581 ..... N84-16080 #
DE84-002654 ..... N84-15613 #
DE84-002723 ..... N84-15737 #
DE84-002731 ..... N84-15128 #
DE84-002742 ..... N84-15989 #
DE84-002743 ..... N84-15991 #
DE84-002813 ..... N84-15276 #
DE84-002831 ..... N84-15227 #
DE84-002845 ..... N84-15383 #
DE84-003009 ..... N84-15952 #
DE84-016306 ..... N84-15359 #

DFVLR-FB-83-23 ..... N84-15740 #
DFVLR-FB-83-25 ..... N84-15163 #
DFVLR-FB-83-29 ..... N84-15409 #
DFVLR-FB-83-30 ..... N84-15879 #

DGLR-81-057 ..... N84-15143* #

DOE-TR-258 ..... N84-15276 #

DOE/BP-189 ..... N84-15738 #

DOE/CE-15148/T3 ..... N84-15359 #

DOE/CS-15072/T5 ..... N84-15687 #
DOE/CS-40338/3 ..... N84-15277 #

DOE/EP-0038/1 ..... N84-15692 #

DOE/ER-03992/529 ..... N84-15383 #
DOE/ER-10692/T1 ..... N84-15358 #
DOE/ER-10755/3 ..... N84-15952 #
DOE/ER-10870/142 ..... N84-15278 #
DOE/ER-40048/73-L3 ..... N84-15954 #

DOE/ET-53088/102 ..... N84-15990 #
DOE/ET-53088/105 ..... N84-15987 #
DOE/ET-53088/107 ..... N84-15985 #
DOE/ET-53088/111 ..... N84-15988 #

DOE/EV-01105/304 ..... N84-15761 #
DOE/EV-03490/2335 ..... N84-15785 #

DOE/MA-40000/T2 ..... N84-16083 #
DOE/MA-40000/T3 ..... N84-16082 #

DOE/NASA/0158/83-1 ..... N84-15879* #
DOE/NASA/0168-6 ..... N84-15554* #
DOE/NASA/51040-50 ..... N84-15246* #

DOE/R4-10406/T1 ..... N84-15291 #
DOE/R5-10326/2 ..... N84-15551

DOE/TIC-4500-REV-89 ..... N84-15297 #

DOT/FAA/AP-83/3 ..... N84-15139 #

DP-MS-83-43 ..... N84-15810 #

DP-1644 ..... N84-15245 #

DR/CG-152-83 ..... N84-15170 #

DR/CWG-104-67 ..... N84-15170 #

DREV-R-4278/82 ..... N84-15962 #

DRSMI/RD-83-11-TR ..... N84-15169 #

DTNSRDC-82/119 ..... N84-15556 #
DTNSRDC-83/048 ..... N84-15204 #
DTNSRDC-83/071 ..... N84-15506 #

DYTEC-8204-VOL-2 ..... N84-15158 #

D180-27738-1 ..... N84-15123* #
D2536-941006 ..... N84-15154* #
D2536-941010 ..... N84-15153* #

E-1700 ..... N84-15394* #
E-1705 ..... N84-15894* #
E-1873 ..... N84-15565* #
E-1901 ..... N84-15246* #

EDR-11443 ..... N84-15554* #

EGG-M-04883 ..... N84-15240 #

EMSB-18/83 ..... N84-15182 #

EOARD-TR-83-4 ..... N84-15683 #
EOARD-TR-83-6 ..... N84-15502 #
EOARD-TR-83-7 ..... N84-15125 #
EOARD-TR-83-14 ..... N84-15794 #

EPA-600/D-83-084 ..... N84-15229 #

ERADCOM/ASL-CR-83-0100-3 ..... N84-15584 #

ESA-CR(P)-1767 ..... N84-15186 #
ESA-CR(P)-1770 ..... N84-15182 #
ESA-CR(P)-1772 ..... N84-15562 #
ESA-CR(P)-1791 ..... N84-15563 #

ESA-ESTL-54 ..... N84-15562 #
ESA-ESTL-55 ..... N84-15563 #

ESA-TT-768 ..... N84-15855 #
ESA-TT-778 ..... N84-15512 #
ESA-TT-794 ..... N84-15529 #
ESA-TT-812 ..... N84-15875 #

ESD-TR-83-028 ..... N84-15903 #
ESD-TR-83-039 ..... N84-15366 #
ESD-TR-83-202 ..... N84-15368 #

ESL-713671-2-VOL-1 ..... N84-15380 #
ESL-714215-2 ..... N84-15365 #
ESL-714258-2 ..... N84-15373 #

ESN-37-9 ..... N84-16079 #

ETS-RR-83-26-ONR ..... N84-15791 #

E84-10035 ..... N84-15626* #
E84-10055 ..... N84-15627* #
E84-10057 ..... N84-15628* #
E84-10059 ..... N84-15629* #
E84-10060 ..... N84-15630* #
E84-10061 ..... N84-15631* #
E84-10063 ..... N84-15632* #
E84-10064 ..... N84-15633* #
E84-10065 ..... N84-15634* #
E84-10066 ..... N84-15635* #
E84-10067 ..... N84-15636* #
E84-10068 ..... N84-15637* #

FAA-AM-83-7 ..... N84-15793 #
FAA-AM-83-11 ..... N84-15781 #
FAA-AM-83-12 ..... N84-15778 #
FAA-AM-83-13 ..... N84-15795 #

FAA-AMS-220 ..... N84-15033 #

FAA-APO-83-2 ..... N84-15141 #

FAA-CT-82-115-VOL-1 ..... N84-15150 #

FAA/EE-82-11-VOL-1 ..... N84-15157 #
FAA/EE-82-11-VOL-2 ..... N84-15158 #
FAA/EE-83-3 ..... N84-15900 #

FERMILAB/TM-1210 ..... N84-15892 #

FFA-137 ..... N84-15132 #

FOA-C-20509-F9 ..... N84-15208 #
FOA-C-30329-E1 ..... N84-15644 #
FOA-C-30331-E ..... N84-15407 #
FOA-C-30341-E ..... N84-15388 #
FOA-C-40178-C2(B2,A3) ..... N84-15408 #
FOA-C-40184-A3 ..... N84-15786 #

FR-1 ..... N84-15983 #

FSU-STATISTICS-M650 ..... N84-15874 #

FTD-ID(RS)T-0285-83 ..... N84-15184 #
FTD-ID(RS)T-0610-83 ..... N84-15963 #
FTD-ID(RS)T-1019-83 ..... N84-16058 #
FTD-ID(RS)T-1095-83 ..... N84-15399 #

FUB-48-1982 ..... N84-15857 #
FUB-49-1982-PT-1 ..... N84-15385 #
FUB-50-1982 ..... N84-15386 #
FUB-51-1982 ..... N84-15387 #
FUB-52-1982 ..... N84-15858 #
FUB-54-1982 ..... N84-15859 #

G-83-3-(34) ..... N84-16061 #
G-83-7-(38) ..... N84-16059 #
G-83-8-(39) ..... N84-16067 #
G-83-11-(42) ..... N84-16066 #

GARRETT-21-4314-1 ..... N84-15247* #

GC-TR-82-260 ..... N84-16002 #

GIT/EES-A-2519 ..... N84-15527 #

GJBX-3(83) ..... N84-15638 #

GT/PDL-171 ..... N84-15360* #

GWU/IRRA/TR-83/3 ..... N84-15567 #

H-83-06 ..... N84-16097* #
H-1197 ..... N84-15588* #

HEDL-SA-2895-FP ..... N84-15570 #
HEDL-SA-2909-FP ..... N84-15255 #
HEDL-SA-2913 ..... N84-15615 #
HEDL-SA-2984-FP ..... N84-15254 #
HEDL-SA-2986 ..... N84-15569 #

HPR-101 ..... N84-15808 #

H1206 ..... N84-15159* #

ICMA-82-35 ..... N84-15861 #

IFSR-111 ..... N84-15968 #

INDU/DC/GMH/TR-83-57 ..... N84-15982 #

INDU/DC/TR-83/5-MC ..... N84-15951 #

INTA-INFORME-I-1/221/720/83047 ..... N84-15281 #

IPPJ-644 ..... N84-15973 #
IPPJ-645 ..... N84-15974 #
IPPJ-646 ..... N84-15975 #
IPPJ-647 ..... N84-15976 #

IRT-8203-005 ..... N84-15528 #
IRT-8213-002 ..... N84-15943 #

IS-M-429 ..... N84-15279 #
IS-M-459 ..... N84-16010 #

ISAS-608 ..... N84-16094 #

ISBN-0-7988-2417-4 ..... N84-15298 #
ISBN-0-7988-2519-7 ..... N84-15188 #
ISBN-92-63-10618-5 ..... N84-15741 #
ISBN-92-835-0257-4 ..... N84-15646 #
ISBN-92-835-0337-6 ..... N84-15034 #
ISBN-92-835-0342-2 ..... N84-15076 #
ISBN-92-835-1442-4 ..... N84-15787 #
ISBN-0902937-88-X ..... N84-15218 #
ISBN-0902937-89-8 ..... N84-15219 #
ISBN-0902937-90-1 ..... N84-15198 #

ISSN-SW-0061-5640 ..... N84-15132 #

ISSN-0077-5606 ..... N84-15217 #
ISSN-0077-5606 ..... N84-15295 #
ISSN-0077-5606 ..... N84-15707 #
ISSN-0285-6808 ..... N84-15424 #
ISSN-0285-6808 ..... N84-15841 #
ISSN-0285-6808 ..... N84-16094 #
ISSN-0347-2124 ..... N84-15408 #
ISSN-0347-2124 ..... N84-15786 #
ISSN-0347-3694 ..... N84-15208 #
ISSN-0347-3708 ..... N84-15388 #
ISSN-0347-3708 ..... N84-15407 #
ISSN-0347-3708 ..... N84-15644 #

JAYCOR-J206-83-007/6221 ..... N84-15751 #
JAYCOR-J206-83-009/6226 ..... N84-15752 #

JHU/APL/TG-1342 ..... N84-15371 #

JPL-400-145-9/82 ..... N84-15168* #

K/CSD/INF-83/20 ..... N84-15836 #

K/PS-5013-EA ..... N84-15548 #

KHR-6 ..... N84-16060* #

KMSF-U1359 ..... N84-15546 #
KMSF-U1360 ..... N84-15542 #
KMSF-U1362 ..... N84-15541 #

L-15631 ..... N84-15117* #

LA-UR-83-2451 ..... N84-16012 #
LA-UR-83-2540 ..... N84-15290 #
LA-UR-83-2744 ..... N84-16114 #
LA-UR-83-2647 ..... N84-15510 #
LA-UR-83-2887 ..... N84-16105 #
LA-UR-83-2896 ..... N84-15718 #
LA-UR-83-2928 ..... N84-16007 #
LA-UR-83-2979 ..... N84-16081 #
LA-UR-83-2982 ..... N84-16003 #
LA-UR-83-2997 ..... N84-15719 #
LA-UR-83-3014 ..... N84-16014 #
LA-UR-83-3042 ..... N84-15405 #
LA-UR-83-3049 ..... N84-15854 #
LA-UR-83-3072 ..... N84-15511 #

LA-9477-MS ..... N84-15978 #
LA-9594-MS ..... N84-15977 #
LA-9650-MS ..... N84-15197 #
LA-9651-MS ..... N84-15292 #
LA-9849-MS ..... N84-15402 #
LA-9856-MS ..... N84-15967 #
LA-9871-MS ..... N84-15561 #

LAIR-158 ..... N84-15758 #

LBL-91 ..... N84-15910 #
LBL-15646 ..... N84-16009 #
LBL-15973 ..... N84-15911 #
LBL-16549 ..... N84-15762 #
LBL-16561 ..... N84-16019 #

LC-83-600000 ..... N84-15228 #
LC-83-600563 ..... N84-15820 #

LCDS-83-16 ..... N84-15846 #

LDGO-82-3 ..... N84-15640 #

LIDS-P-1298 ..... N84-15379 #

LMF-102 ..... N84-15694 #

LMI-DL302 ..... N84-16077 #

LMSC-D877499 ..... N84-15957* #

MDC-Q1203 ..... N84-15540 #

MEMO/M-460 ..... N84-15618 #

MERADCOM-2381 ..... N84-15286 #

MIMEO SER-1527 ..... N84-15847 #

MIMEO-SER-1526 ..... N84-15867 #
MIMEO-SER-1528 ..... N84-15868 #

MIT-RR-R2-2 ..... N84-15586 #

MIT/LCS/TM-242 ..... N84-15827 #

MLM-3112(OP) ..... N84-15227 #

MPL-U-42/83 ..... N84-15753 #
MPL-U-51/83 ..... N84-15902 #

MRDC41078.9FR ..... N84-15995 #

MRL-TN-460-PT-2 ..... N84-15558 #

MSRR-494 ..... N84-15852 #

MTR-8409 ..... N84-15368 #

NADC-81189-60 ..... N84-15137 #
NADC-81190-60 ..... N84-15148 #
NADC-83049-60 ..... N84-15784 #
NADC-83050-60 ..... N84-15782 #
NADC-83051-60 ..... N84-15783 #
NADC-83062-40 ..... N84-15364 #

NAE-AN-13 ..... N84-15136 #
NAE-AN-14 ..... N84-15503 #

NAS 1.12/7:7011(252) N84-15763*
NAS 1.15:76947 ..... N84-15143* #
NAS 1.15:76974 ..... N84-15248* #
NAS 1.15:77025 ..... N84-15118* #
NAS 1.15:77085 ..... N84-15552* #
NAS 1.15:77092 ..... N84-15270* #
NAS 1.15:77285 ..... N84-15981* #
NAS 1.15:77337 ..... N84-15709* #
NAS 1.15:77338 ..... N84-15789* #
NAS 1.15:77347 ..... N84-15124* #
NAS 1.15:77349 ..... N84-15519* #
NAS 1.15:77370 ..... N84-15119* #
NAS 1.15:77373 ..... N84-15122* #
NAS 1.15:77374 ..... N84-15980* #
NAS 1.15:82550 ..... N84-15866* #
NAS 1.15:82562 ..... N84-16075* #
NAS 1.15:82563 ..... N84-15269* #
NAS 1.15:83506 ..... N84-15249* #
NAS 1.15:83535 ..... N84-15246* #
NAS 1.15:84594 ..... N84-15120* #
NAS 1.15:84617 ..... N84-15172* #
NAS 1.15:84658 ..... N84-15426* #
NAS 1.15:84920 ..... N84-15159* #

NAS 1.15:84925 ..... N84-15588* #
NAS 1.15:85066 ..... N84-15555* #
NAS 1.15:85074 ..... N84-16108* #
NAS 1.15:85113 ..... N84-15958* #
NAS 1.15:85115 ..... N84-15731* #
NAS 1.15:85123 ..... N84-16107* #
NAS 1.15:85124 ..... N84-15941* #
NAS 1.15:85486 ..... N84-16076* #
NAS 1.15:85487 ..... N84-15164* #
NAS 1.15:85492 ..... N84-16021* #
NAS 1.15:85493 ..... N84-16020* #
NAS 1.15:85510 ..... N84-16060* #
NAS 1.15:85515 ..... N84-15634* #
NAS 1.15:85516 ..... N84-15635* #
NAS 1.15:85517 ..... N84-15636* #
NAS 1.15:85518 ..... N84-15637* #
NAS 1.15:85662 ..... N84-15117* #
NAS 1.15:85727 ..... N84-15898* #
NAS 1.15:85728 ..... N84-15199* #
NAS 1.15:85730 ..... N84-15145* #
NAS 1.15:85734 ..... N84-15200* #
NAS 1.15:85738 ..... N84-15201* #
NAS 1.15:175134 ..... N84-15708* #
NAS 1.21:462 ..... N84-15144* #
NAS 1.26:3721 ..... N84-15114* #
NAS 1.26:3741 ..... N84-15135* #
NAS 1.26:3753 ..... N84-15196* #
NAS 1.26:3756 ..... N84-15565* #
NAS 1.26:3761 ..... N84-15425* #
NAS 1.26:3763 ..... N84-15115* #
NAS 1.26:3766 ..... N84-15706* #
NAS 1.26:3768 ..... N84-15587* #
NAS 1.26:3771 ..... N84-15729* #
NAS 1.26:77293 ..... N84-15553* #
NAS 1.26:85686 ..... N84-15179* #
NAS 1.26:165428 ..... N84-15154* #
NAS 1.26:166506 ..... N84-15877* #
NAS 1.26:167916 ..... N84-15679* #
NAS 1.26:167927 ..... N84-15153* #
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NAS 1.26:168218 ..... N84-15247* #
NAS 1.26:168235 ..... N84-15554* #
NAS 1.26:168284 ..... N84-15682* #
NAS 1.26:168296-VOL-1 ..... N84-15155* #
NAS 1.26:168296-VOL-2 ..... N84-15156* #
NAS 1.26:168323 ..... N84-15151* #
NAS 1.26:168330 ..... N84-15152* #
NAS 1.26:170482 ..... N84-16071* #
NAS 1.26:170547 ..... N84-16072* #
NAS 1.26:170548 ..... N84-16073* #
NAS 1.26:170550 ..... N84-16074* #
NAS 1.26:170612 ..... N84-15535* #
NAS 1.26:170940 ..... N84-15178* #
NAS 1.26:170941 ..... N84-16112* #
NAS 1.26:170942 ..... N84-16022* #
NAS 1.26:170943 ..... N84-15284* #
NAS 1.26:170943 ..... N84-15428* #
NAS 1.26:170947 ..... N84-15732* #
NAS 1.26:170948 ..... N84-16097* #
NAS 1.26:170949 ..... N84-15171* #
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NAS 1.26:170952 ..... N84-15521* #
NAS 1.26:170953 ..... N84-15165* #
NAS 1.26:170957 ..... N84-15267* #
NAS 1.26:170958 ..... N84-15755* #
NAS 1.26:171724 ..... N84-15174* #
NAS 1.26:171725 ..... N84-15175* #
NAS 1.26:171726 ..... N84-15176* #
NAS 1.26:171727 ..... N84-15177* #
NAS 1.26:172239 ..... N84-15123* #
NAS 1.26:172267 ..... N84-15811* #
NAS 1.26:172273 ..... N84-15896* #
NAS 1.26:172274 ..... N84-15897* #
NAS 1.26:172279 ..... N84-15268* #
NAS 1.26:173136 ..... N84-15627* #
NAS 1.26:173138 ..... N84-15628* #
NAS 1.26:173140 ..... N84-15629* #
NAS 1.26:173141 ..... N84-15630* #
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NAS 1.26:173144 ..... N84-15633* #
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NAS 1.26:174503 ..... N84-15681* #
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NAS 1.26:174506 ..... N84-15997* #
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NAS 1.26:174619 ..... N84-15710* #
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NAS 1.26:175122 ..... N84-15730* #
NAS 1.26:175123 ..... N84-15632* #
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NAS 1.26:175131 ..... N84-15957* #
NAS 1.26:175132 ..... N84-15972* #
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NAS 1.26:175324 ..... N84-15168* #
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NAS 1.26:175328 ..... N84-15909* #
NAS 1.26:175329 ..... N84-16095* #
NAS 1.26:175330 ..... N84-16096* #
NAS 1.55:2284 ..... N84-15590* #
NAS 1.55:2287 ..... N84-15327* #
NAS 1.60:2248 ..... N84-15394* #
NAS 1.60:2259 ..... N84-15894* #
NAS 1.60:2263 ..... N84-15427* #
NAS 1.60:2264 ..... N84-15880* #

NASA-CASE-ARC-11368-3 ..... N84-15202* #

NASA-CASE-GSC-12849-1 ..... N84-15960* #

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NASA-CASE-LAR-12738-2 ..... N84-15180* #
NASA-CASE-LAR-12881-2 ..... N84-15271* #

NASA-CASE-LEW-13828-1 ..... N84-15203* #

NASA-CASE-MFS-25946-1 ..... N84-15183* #

NASA-CASE-NPO-15890-1 ..... N84-15536* #
NASA-CASE-NPO-16271-1 ..... N84-15537* #

NASA-CP-2284 ..... N84-15590* #
NASA-CP-2287 ..... N84-15327* #

NASA-CR-3721 ..... N84-15114* #
NASA-CR-3741 ..... N84-15135* #
NASA-CR-3753 ..... N84-15196* #
NASA-CR-3756 ..... N84-15565* #
NASA-CR-3761 ..... N84-15425* #
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NASA-CR-165428 ..... N84-15154* #
NASA-CR-166506 ..... N84-15877* #
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NASA-CR-167927 ..... N84-15153* #
NASA-CR-168179 ..... N84-15283* #
NASA-CR-168218 ..... N84-15247* #
NASA-CR-168235 ..... N84-15554* #
NASA-CR-168284 ..... N84-15682* #
NASA-CR-168296-VOL-1 ..... N84-15155* #
NASA-CR-168296-VOL-2 ..... N84-15156* #
NASA-CR-168323 ..... N84-15151* #
NASA-CR-168330 ..... N84-15152* #
NASA-CR-170482 ..... N84-16071* #
NASA-CR-170547 ..... N84-16072* #
NASA-CR-170548 ..... N84-16073* #
NASA-CR-170550 ..... N84-16074* #
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NASA-CR-170940 ..... N84-15178* #
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NASA-SP-482 ..... N84-15144* #
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NASA-TM-76947 ..... N84-15143* #
NASA-TM-76974 ..... N84-15248* #
NASA-TM-77025 ..... N84-15118* #
NASA-TM-77085 ..... N84-15552* #
NASA-TM-77092 ..... N84-15270* #
NASA-TM-77285 ..... N84-15981* #
NASA-TM-77293 ..... N84-15553* #
NASA-TM-77337 ..... N84-15709* #
NASA-TM-77338 ..... N84-15789* #
NASA-TM-77347 ..... N84-15124* #
NASA-TM-77349 ..... N84-15519* #
NASA-TM-77370 ..... N84-15119* #
NASA-TM-77373 ..... N84-15122* #
NASA-TM-77374 ..... N84-15980* #
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NASA-TM-82562 ..... N84-16075* #
NASA-TM-82563 ..... N84-15269* #
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NASA-85074 ..... N84-16108* #

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NBS-SP-500-103 ..... N84-15820 #

NBSIR-82-2581 ..... N84-15742 #

NCEL-TN-1664 ..... N84-15843 #

NLR-MP-82007-U ..... N84-15513 #
NLR-MP-82014-U N84-15113
NLR-MP-82015-U ..... N84-15819 #
NLR-MP-82020-U ..... N84-15131 #
NLR-MP-82021-U ..... N84-15616 #
NLR-MP-82023-U ..... N84-15617 #
NLR-MP-82024-U ..... N84-15860 #
NLR-MP-82026-U ..... N84-15856 #
NLR-MP-82027-U ..... N84-15861 #
NLR-MP-82030-U ..... N84-15862 #
NLR-MP-82032-U ..... N84-15798 #
NLR-MP-82041-U ..... N84-15149 #

NOR-83-84 ..... N84-15251 #

NORDA-TN-171 ..... N84-15747 #
NORDA-TN-222 ..... N84-15746 #
NORDA-TN-224 ..... N84-15748 #
NORDA-TN-240 ..... N84-15749 #
NORDA-TN-241 ..... N84-15750 #

NORSAR-CONTRIB-334 N84-15713 #

NORSAR-SCIENTIFIC-2-82/83 N84-15713 #

NPRDC-TR-83-32 N84-15824 #

NRC-21379 N84-15136 #
NRC-22448 N84-15503 #

NRC/CNR-TT-2067 N84-15295 #
NRC/CNR-TT-2070 N84-15707 #
NRC/CNR-TT-2073 N84-15217 #

NRL-MR-5108 N84-15945 #
NRL-MR-5149 N84-15961 #
NRL-MR-5161 N84-15989 #
NRL-MR-5164 N84-15140 #
NRL-MR-5167 N84-15367 #
NRL-MR-5171 N84-16113 #
NRL-MR-5176 N84-15947 #
NRL-MR-5179 N84-15505 #
NRL-MR-5186 N84-15991 #
NRL-MR-5187 N84-15536 #
NRL-MR-5191 N84-15948 #

NRL-8694 N84-15369 #
NRL-8729 N84-15396 #

NR092-549-TR28 N84-15949 #

NSMRL-SR-83-1 N84-15777 #

NSTL/ERL-212 N84-15635* #
NSTL/ERL-218 N84-15636* #
NSTL/ERL-225 N84-15637* #

NSWC/TR-83-236 N84-15374 #

NT-81-19 N84-15119* #

ONERA-NT-1981-10 N84-15855 #
ONERA-NT-1982-1 N84-15512 #
ONERA-NT-1982-4 N84-15875 #

ONERA-TP-1981-117 N84-15118* #

ONR-TR-160 N84-15874 #

ONRL-R-7-83 N84-15797 #

ORC-83-4 N84-16065 #
ORC-83-5 N84-15835 #

ORNL-5943 N84-15187 #

ORNL/CSD-TM-200 N84-15865 #

ORNL/TM-8713 N84-15984 #
ORNL/TM-8833 N84-15979 #
ORNL/TM-8863 N84-15986 #

OSU-ONR-TR-83-5 N84-15362 #

OSURF-TR-25 N84-15222 #

OWRT-A-125-NC(1) N84-15645 #

PB83-139378 N84-15742 #
PB83-147421 N84-15833 #
PB83-166751 N84-15864 #
PB83-166769 N84-15390 #
PB83-216911 N84-15618 #
PB83-217265 N84-15863 #
PB83-217273 N84-15410 #
PB83-217489 N84-15969 #
PB83-217586 N84-15389 #
PB83-225409 N84-15228 #
PB83-232090 N84-15229 #
PB83-256750 N84-15645 #
PB83-257618 N84-15820 #

PMIC-MA03-469-29 N84-15171* #

PNL-SA-10660 N84-15728
PNL-SA-11539 N84-16080 #

PO-83-506 N84-15171* #

PREPRINT-149 N84-15981* #

PTPT-83-R-04 N84-15557 #

R-1-83 N84-15800 #

RADC-TR-83-51 N84-15181 #
RADC-TR-83-60 N84-15816 #
RADC-TR-83-86 N84-15372 #
RADC-TR-83-100 N84-15361 #
RADC-TR-83-127 N84-15995 #
RADC-TR-83-182 N84-15999 #
RADC-TR-83-183 N84-15373 #
RADC-TR-83-209 N84-15998 #

RAE-LIB-TRANS-2098 N84-15265 #

RAND/N-2027-AF N84-16064 #

RCC/MG-367-83 N84-15734 #
RCC/MG-368-83 N84-15736 #

REPT-82-29 N84-15833 #
REPT-82-004 N84-15969 #
REPT-83-03 N84-15863 #
REPT-83-63 N84-15896* #
REPT-83-64 N84-15897* #
REPT-83F0228 N84-15555* #
REPT-83F5158 N84-15327* #
REPT-340-20209 N84-15610 #
REPT-605 N84-15841 #
REPT-606 N84-15424 #
REPT-684 N84-16107* #
REPT-1982-02 N84-15390 #
REPT-1982-05 N84-15864 #
REPT-1983-01 N84-15389 #
REPT-1983-04 N84-15410 #
REPT-3012C4:WGM N84-15185 #
REPT-8212 N84-15834 #
REPT-23499-8033-UT.00 N84-15972* #

RFP-3442 N84-15296 #
RFP-3455 N84-15297 #

RI/RD83-170 N84-15284* #
RI/RD83-170 N84-15428* #

RLE-125 N84-16016 #

ROLLAB-MEMO-RM-096 N84-15161 #

RRL-PUB-526 N84-15535* #

RSC-3458-130-VOL-2 N84-15629* #

RUB-IFM-MITT-34 N84-15582

R664 N84-15186 #
R857/2 N84-15971
R8310-6-VOL-1 N84-15174* #
R8310-6-VOL-2-PT-1 N84-15175* #
R8310-6-VOL-2-PT-2 N84-15176* #
R8310-6-VOL-3 N84-15177* #

SAI/PR-TR-13 N84-15425* #

SAM-TR-83-17-VOL-1 N84-15756 #
SAM-TR-83-24 N84-16068 #
SAM-TR-83-33 N84-15760 #

SAND-82-2543 N84-15613 #
SAND-83-0591C N84-16008 #
SAND-83-1278C N84-15280 #
SAND-83-1590 N84-15717 #
SAND-83-1636C N84-15129 #
SAND-83-1657C N84-16006 #
SAND-83-1714C N84-15258 #
SAND-83-2013C N84-15126 #
SAND-83-2148C N84-16004 #
SAND-83-2267C N84-15403 #
SAND-83-2298C N84-15406 #

SAR-3 N84-15681* #

SER-246 N84-15295 #
SER-248 N84-15707 #

SERI/TP-211-1984 N84-15680 #
SERI/TP-211-2048 N84-15691 #
SERI/TP-215-2009 N84-15905 #
SERI/TP-252-1775 N84-15423
SERI/TP-253-1839 N84-15676 #
SERI/TP-253-1870 N84-15678 #

SERI/TR-253-1906 N84-15689 #

SM-8 N84-15589* #

SONEX-838151 N84-15559 #

SR-18-VOL-1 N84-15756 #

SSD-T-4-8234-006-82 N84-16071* #
SSD-T-8234-005-82 N84-16074* #
SSD-T-8237-002-82 N84-16072* #
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SSS-R-83-5776 N84-15714 #

SU-DMS-83-R-5 N84-15997* #

SU-SLAC-PUB-3136 N84-16018 #
SU-SLAC-PUB-3169 N84-15955 #

SUNYBUF/DC/TR-14 N84-15220 #

TACOM-TR-12688 N84-15826 #

TAE-483 N84-15876 #
TAE-497 N84-15585 #

TDI-TR-83-4 N84-15796 #

TOXICOLOGY-SER-42 N84-15758 #

TR-2 N84-15224 #
TR-3 N84-15277 #
TR-4 N84-15397 #
TR-7 N84-15944 #
TR-11 N84-16059 #
TR-12 N84-15252 #
TR-12 N84-16067 #
TR-14 N84-15815 #
TR-15 N84-16061 #
TR-38 N84-15942 #
TR-82-04-121 N84-15826 #
TR-83-37 N84-15869 #
TR-83-38 N84-15870 #
TR-83-39 N84-15871 #
TR-102 N84-15809 #
TR-113-11 N84-15848 #
TR-333 N84-15844 #
TR-656 N84-15366 #

U-ROCHESTER/DC/83/TR-40 N84-15193 #

UC-37 N84-15910 #

UCID-19818 N84-15259 #
UCID-19918 N84-15382 #

UCLA-ENG-83-24 N84-15377 #
UCLA-ENG-83-25 N84-15375 #
UCLA-ENG-83-26 N84-15378 #

UCRL-TRANS-11918 N84-15612 #
UCRL-TRANS-11923 N84-15507 #

UCRL-15559-VOL-1 N84-15547 #
UCRL-15562 N84-15688 #
UCRL-88995 N84-15968 #
UCRL-89385 N84-15818 #
UCRL-89811 N84-16102 #
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UCRL-89861 N84-15226 #
UCRL-89923 N84-15509 #
UCRL-89964 N84-15737 #

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